DOCUMENT RESUME

ED 131 247 CE 008 364

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TITLE Burn Injuries: Causes, Consequences, Knowledge, Behaviors.
INSTITUTION Education Development Center, Inc., Newton, Mass.; Massachusetts General Hospital, Boston.; National Fire Protection Association, Boston, Mass.; Shriners Burns Inst., Boston, Mass.
SPONS AGENCY Consumer Product Safety Commission, Washington, D.C.
PUB DATE Jun 76
CONTRACT CPSC-C-75-0107
NOTE 324p.

EDRS PRICE MF-$0.83 HC-$16.73 Plus Postage.
DESCRIPTORS Adolescents; Adults; *Age Groups; Children; Clinical Diagnosis; Educational Assessment; *Educational Diagnosis; *Fire Protection; First Aid; *Injuries; Intervention; Medical Research; *Needs Assessment; Older Adults; Safety; Safety Education; Tables (Data)
IDENTIFIERS Massachusetts

ABSTRACT

This report covers Phase I of the Burn Injury Education Demonstration Project, a four-phased project designed to explore the feasibility of using educational intervention strategies to increase knowledge and appropriate behaviors and attitudes to reduce the number and severity of burns. Phase I involved a comprehensive needs assessment conducted to determine the patterns of burn accidents, profiles of burn victims, and the current state of knowledge, deficits, and misconceptions with regard to the prevention and emergency treatment of burn injuries. Two major research activities are discussed: Collection of burn data and educational diagnosis Burn accident data are presented in two formats--(1) State Burn Incidence Data, derived solely from burn reports received from the Massachusetts Department of Public Health, and (2) Burn Victim Profile Data, derived from accident investigations and interviews with burn victims. The educational diagnosis data are based on the results of several instruments (a criterion-referenced test, a telephone survey, and home interviews) and are organized according to the nature and extent of knowledge, and the behavior and practices of the sample populations. Both burn incidence data and the results of the educational diagnosis are presented for six sample age groups: Children under 3 years of age and their parents, children aged 3 to 8, children aged 9 to 12, adolescents aged 13 to 19, adults aged 20 to 59, and elderly persons aged 60 and above. (Author)

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ED131247

BURN INJURIES:

CAUSES, CONSEQUENCES, KNOWLEDGE, BEHAVIORS

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EDUCATION

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Massachusetts General Hospital
Shriners Burns Institute
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Boston, Massachusetts

June 1976

CE 008 364

Funded by the U.S. Consumer Product Safety Commission

This project has been funded with Federal funds from the United States Consumer Product Safety Commission under contract number CPSC-C-75-0107. The content of this publication does not necessarily reflect the views of the Commission, nor does mention of trade names, commercial products, or organizations imply endorsement by the Commission.

ABSTRACT

This Report covers Phase I of the Burn Injury Education Demonstration Project, a four-phased project designed to explore the feasibility of using educational intervention strategies to increase knowledge and appropriate behaviors and attitudes to reduce the number and severity of burns. During Phase I, a comprehensive needs assessment was conducted to determine the patterns of burn accidents, profiles of burn victims, and the current state of knowledge, deficits, and misconceptions with regard to the prevention and emergency treatment of burn injuries. This Report discusses the findings of the two major research activities: the collection of burn data, and the educational diagnosis.

Burn accident data are presented in two distinct formats: 1) State Burn Incidence Data, derived solely from burn reports received from the Massachusetts Department of Public Health, and 2) Burn Victim Profile Data, derived from accident investigations and interviews with burn victims. The Educational Diagnosis was based on the results of several instruments, including a criterion-referenced test, a telephone survey, and home interviews. Data are organized in the report according to the nature and extent of knowledge and the behavior and practices of the sample populations. Both Burn Incidence Data and the results of the Educational Diagnosis are presented by sample age-groups: Children Under 3 and Their Parents, Children 3 to 8 Years of Age, Children 9 to 12 Years of Age, Adolescents 13 to 19 Years of Age, Adults 20 to 59 Years of Age, and Elderly Persons 60+ Years of Age.

Also included in the Final Report are a description of methodology, summary of research findings, presentation of findings by the six risk-groups listed above, and conclusions.

ACKNOWLEDGEMENTS

Four Boston area institutions collaborated in Phase I of the Burn Injury Education Demonstration Project, each contributing personnel and expertise to certain assigned tasks.

MASSACHUSETTS GENERAL HOSPITAL assumed primary contractual responsibility for the project. The Committee on Research, under the experienced direction of its Executive Secretary, Ralph G. Meader, PhD, and the Sub-Committee on Human Studies monitored project activities which involved issues of contract confidentiality. Special thanks are due June Crolius, Research Administration Assistant in the office of the Committee on Research, and Mark Flaim in the Special Funds Department where the project's accounts were managed.

SHRINERS BURNS INSTITUTE provided the project's headquarters, as well as a compelling daily reminder that better methods of coping with the burn injury problem must be found. Personnel included John D. Crawford, MD, Principal Investigator; Elizabeth McLoughlin, Project Director; and Ninon Freeman, Project Assistant. Melissa Chait, Joan Flynn, and Marie Whitten conducted all burn victim interviews; Deborah Parker coded the burn investigation and interview files; Martin Tannenbaum assisted in data analysis. This SBI staff assumed responsiblity for the overall direction of the project, the coordination of the work at all four institutions, and collection and analysis of the Burn Profile Data in the Final Report. John Locke, of the U.S. Consumer Product Safety Commission - Boston Area Office, gave invaluable assistance in data collection, analysis and interpretation, drawing on his ten years of experience as a burn accident field investigator.

EDUCATION DEVELOPMENT CENTER assumed responsibility for the project's educational component. The design for the Educational Diagnosis in Phase I was developed by Karen C. Cohen, PhD, Eileen Peters and Myles Gordon. Cheryl Healer as the EDC Project Director had major responsibility for implementation for Phase I. The work of EDC was accomplished by many people: Vivian Guilfoy as educational program developer, Ann Lee as research assistant, John Murphy as statistician, and Paul Ross as computer programmer. Judy Halpern and Nicole Riesman administered all in-school questionnaires and interviews. Many thanks to the school superintendents, principals and teachers, whose cooperation allowed us to discover

valuable information of what students don't know about burn prevention. One aspect of the Educational Diagnosis, the telephone survey, was conducted by Marttila, Payne, Kiley and Thorne, under the supervision of Rebecca Crawford, and EDC.

NATIONAL FIRE PROTECTION ASSOCIATION assumed responsibility for the collection and analysis of the burn injury baseline data. F. James Kauffman collaborated with George A. Michael, Sc.D., and the staff at the Massachusetts Department of Public Health in utilizing the mandatory state burn reporting system. Michael Karter did the computer programming and data analysis for the burn incidence data.

THE FINAL REPORT: This Final Report presents the research findings of Phase I of the B.I.E.D.P., made possible by the combined efforts of all the people mentioned above. Primary authorship of the report rests with Cheryl Healer, Vivian Guilfoy, and Elizabeth McLoughlin, with special contributions made by F. James Kauffman, Ann Lee, and Ninon Freeman. Anne Glickman edited the Final Report, incorporating valuable comments from reviewers John D. Crawford, Eileen Peters, Whitewood Stamps, Inc., Lee Liberman, and Raymond Mafley. Meg Westlund and Pamela Ponce de Leon were helpful in facilitating the work and seeing to the myriad details associated with the production of the report. Ann Schwartz and Patricia Jones prepared the charts, diagrams, and report for final copy. Maria Rainho skillfully typed the final report.

The Project staff are grateful to William V. White, Director of the Bureau of Information and Education, U.S.C.P.S.C., to Karen Klam, original architect of the Project, and to Sherry Remez, Project Officer, for their unfailing support, manifested in their availability to us for consultation. We are also grateful to them for their skill in bringing the financial and technical resources of the Commission to bear both on the burn problem and the Burn Project.

A final and special word of thanks to those burn victims and their families whose willingness to share their experiences and to reflect on how these experiences could help prevent similar accidents, gave the project staff a heightened sense of purpose.

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Introduction

Introduction

The burn accident is a medical, social, environmental, and financial problem of national proportions. The Burn Injury Education Demonstration Project, funded by the Consumer Product Safety Commission (CPSC), is designed to explore the feasibility of using educational strategies to increase knowledge, change attitudes, alter burn-safety-related behavior, and thereby reduce the number and severity of burn injuries among all age groups. Another important goal of this project is to develop a model that is generalizable to other geographic locations (bearing in mind considerations in climate and life style), so that any major city or community can replicate it in order to heighten people's awareness of burn accidents, add to their knowledge, and equip them to protect themselves and their families from burn injury.

A consortium of Boston institutions collaborate on the project. Massachusetts General Hospital administers the contract; Shriners Burns Institute provides project direction and is responsible for the burn victim profile data; Education Development Center is responsible for the design and implementation of the educational diagnosis; the National Fire Protection Association is responsible for the burn incidence data.

The project is being carried out in two sites. The Boston Standard Metropolitan Statistical Area (SMSA) is the experimental site and the Springfield (Mass.) SMSA is the control site.

The project has a four-phase design: Phase I--Needs Assessment; Phase II--Program Development; Phase III--Program Implementation; and Phase IV--Evaluation. The present contract encompassed Phase I.

Phase I has involved two major research activities: the collection of burn incidence data, and educational diagnosis. Both activities were intended as preparation for the development of burn prevention strategies.

The primary source for burn incidence data has been the Massachusetts Department of Public Health. As required by law, all burn injuries over 5% of total body surface must be reported to this department. Burn victim profiles and patterns of accidents are drawn from these reports and from records on file at the CPSC Boston office and local burn units.

Educational diagnosis involved assessing attitudes, knowledge, and behaviors which investigation of burn victim case studies suggest might be related to the burn accident. A variety of instruments provided information for diagnosis about a sample of specific high risk populations in both the experimental and the control site.

Findings about the relationship between actual burn accident patterns and deficiencies or misconceptions in knowledge will form the foundation for Phase II.

Phase II will involve the development and pilot testing of materials and strategies in the two sites. Educational intervention will occur in three ways: a media effort directed toward all adults across the entire Boston SMSA; a community outreach program targeted toward parents of children (from birth to 10 years) and the elderly in one town/community within the Boston SMSA; and a school-based effort aimed at all school-age children (K-12) in another town/community within the Boston SMSA.

Phase III will involve full-scale implementation of the educational materials and strategies developed during Phase II; Phase IV will involve evaluation of their effectiveness. Evaluation will focus on two basic dimensions: the incidence of burn injuries; and changes in knowledge, attitudes, and appropriate behaviors.

Summary of Research Findings

State Burn Incidence Data

The 611 burn injury reports submitted to the Massachusetts Department of Public Health during a six-month period (October 1975 through March 1976) were analyzed. The project used seven age groupings for its analysis. The following table presents these seven age groups in terms of their percentage of the total Massachusetts population, their percentage of the burn population as defined by the state reports, and the ratio of these percentages. The actual distribution of burns by age and sex (588 could be coded by age, 547 by sex) is also included.

Distribution of Burn Incidence Data by Age and Sex

Age Group		(A) % Total Mass. Pop.	(B) % Burn Population	Ratio (B):(A)	Total N	Male	Female	
0-2	N			3.04:1	89	50	35	
	%	4.8%	14.6%		15%	57%	41%	
3-8	N			.89:1	60	37	17	
	%	11.0%	9.8%		10%	69%	31%	
9-12	N			.46:1	22	15	6	
	%	7.8%	3.6%		4%	71%	29%	
13-19	N			1.21:1	95	60	33	
	%	12.8%	15.5%		16%	65%	35%	
20-44	N			1.06:1	201	112	73	
	%	30.9%	32.9%		34%	61%	39%	
45-59	N			.61:1	63	31	23	
	%	16.8%	10.3%		11%	57%	43%	
60+	N			.60:1	58	22	33	
	%	15.6%	9.5%		10%	40%	60%	
					588	327	220	= 547

This sample indicates that the very young are at greatest risk. Adolescents and young adults are the other two groups whose members are burned more frequently than would be indicated by their representation in the total population of Massachusetts. Males are more at risk than females in all age groups except the elderly, when females in the population outnumber males. It is in the preadolescent age group that the burn risk for males is most marked in this sample.

The distribution of these injuries by age group and type of burn is presented in the following table:

Distribution of Burn Incidence Data by Age and Type of Burn

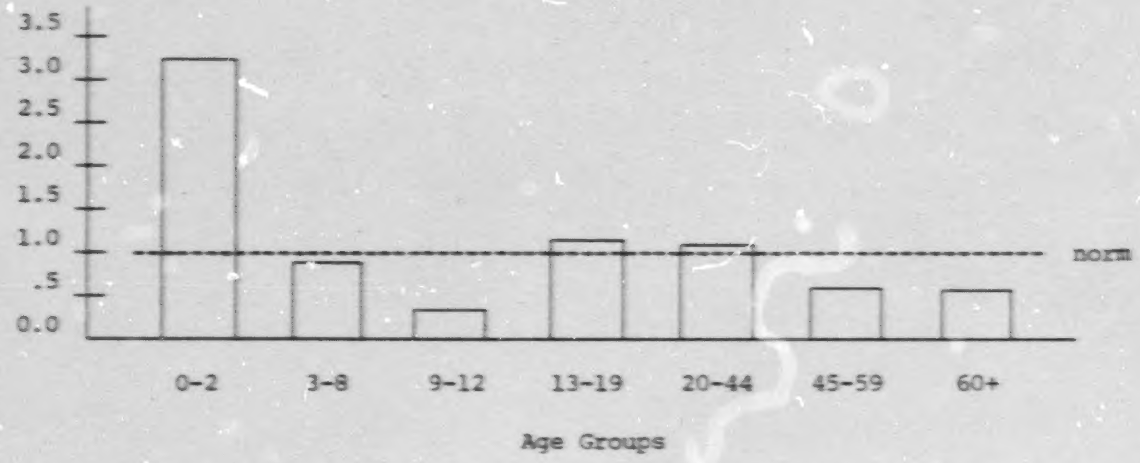
Age Group	Scald	Flame	Contact	Chemical	Radiation	Electric	Unknown	Total N
0-2	57	3	21	3	—	—	5	89
	64%	3%	24%	3%	—	—	6%	15%
3-8	38	11	4	—	—	4	3	60
	63%	18%	7%	—	—	7%	5%	10%
9-12	11	7	2	—	—	1	1	22
	50%	32%	9%	—	—	5%	5%	4%
13-19	39	27	13	6	7	3	—	95
	41%	28%	14%	6%	7%	3%	—	16%
20-44	74	67	28	17	7	2	6	201
	37%	33%	14%	9%	4%	1%	3%	34%
48-59	21	24	4	4	1	—	9	63
	33%	38%	6%	6%	2%	—	14%	11%
60+	22	24	6	2	—	1	3	58
	38%	41%	10%	3%	—	2%	5%	10%
Total N	262	163	78	32	15	11	27	588
%	45%	28%	13%	5%	3%	2%	5%	100%

This summary of research findings presents four considerations concerning burn incidence from these state reports: (1) "populations-at-risk"; (2) relative frequencies of different types of burns; (3) relative severity of different types of burns; (4) relationship between age group and type of burn.

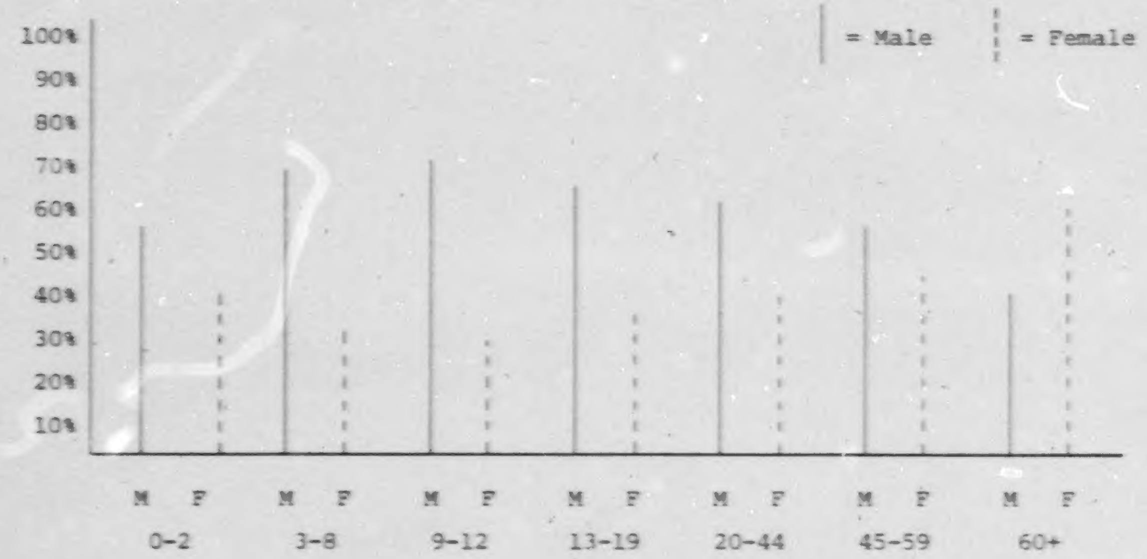
The first consideration is that of "populations-at-risk" by age and sex.

The following charts present this consideration graphically.

Ratio: Burn Population/State Population

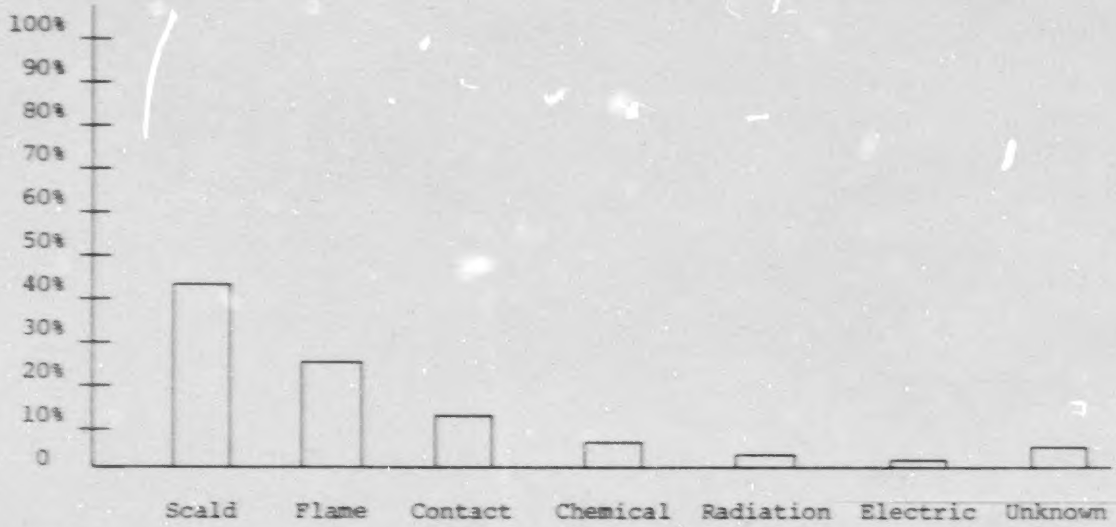


Male-Female Distribution Within Age Groups



A second consideration is that of the relative frequencies of different types of burns, regardless of age of victim.

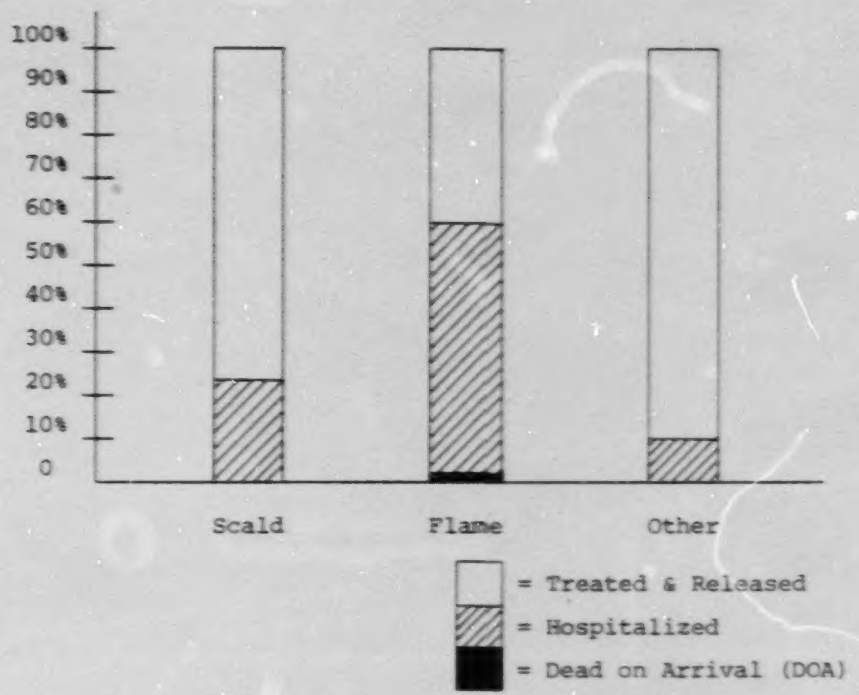
Distribution of Burn Incidence by Type of Burn



In this study sample, scald burns are the most common type of burn, representing 44% of all reported injuries. Flame burns are the second most common burn (27%), with contact burns (13%), chemical burns (5%), radiation (sunburn, sunlamp) burns (3%), and electric burns (2%), completing the total of identified burns. Unknown burns (6%) represent cases for which sufficient identifying data were lacking on the written form submitted to the state.

A third consideration is that of the relative severity of these different types of burns. The state reports provide information on patient disposition (treated and released, hospitalized, dead on arrival), by type of burn, grouped by scald burn, flame burn, and all other burns.

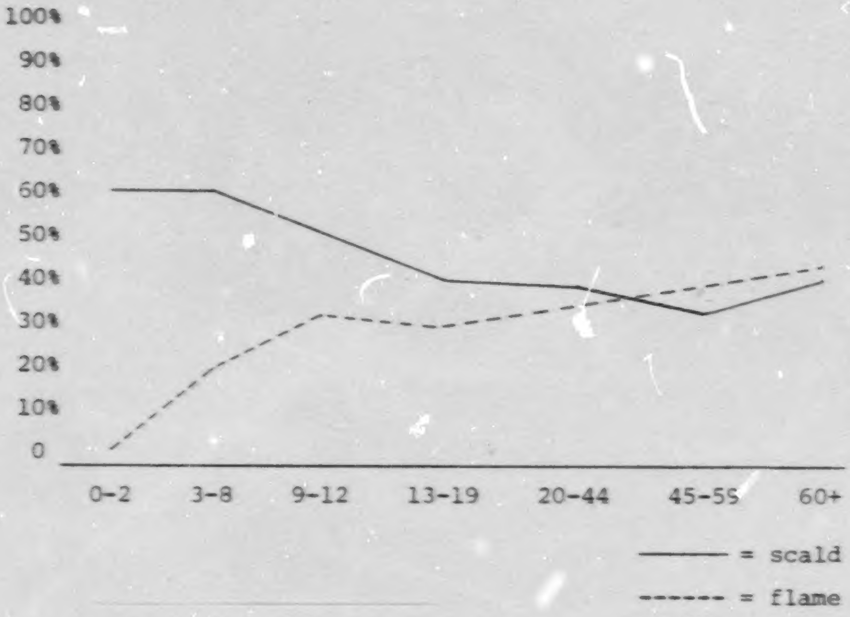
Distribution of Patient Disposition by Type of Burn



It is evident in this sample that the flame burn inflicts the most severe injuries, in that 55% of all flame burn victims were hospitalized, and the only patients dead on arrival (3%) at the hospital had been injured in a fire. The scald burn victims were hospitalized in 24% of the cases, while all other burn victims were hospitalized in only 11% of the reported cases. Because these reports are by law submitted to the state within fourteen days after initial treatment, it is impossible to determine how many of these hospitalized patients died of their burns. It would be a mistake to assume that only 3% (DOA) of these reported burns were fatal. Data from the burn injury investigation files reveal a 13% fatality rate for flame burn victims.

A fourth consideration is that of the relationship between age group and type of burn most frequently sustained. An interesting pattern can be traced when looking at scald and flame incidence for different age groups.

Distribution of Scald and Flame Burns by Age Groups*



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*Data derived from table on page 1-7.

The scald burn incidence is highest for the youngest children (64%), and it decreases after the age of 8. The flame burn curve goes in the opposite direction, reflecting low incidence (3%) among the youngest children; it increases in frequency, leveling off from preadolescence into adulthood, until, among the older adults and elderly, the flame burn exceeds the scald burn in frequency. Scald-flame burns predominate in all age groups except for children under 3, for whom contact burns replace flame burns in second rank.

The most common scald burns are those which happen in the kitchen, when hot liquids (coffee, tea, water, soup, oil, grease) are spilled during meal preparation and serving time. Young children tip over containers of hot liquids or are underfoot in the kitchen. Bathtub accidents are common for toddlers and the elderly, less so for older children and adults. Haste and distraction are factors in scald burns among adults.

Flame burns happen most frequently when a child or adult contacts a single-ignition source, such as a stove, match or other open flame, while trying to start or use a fire.

Dwelling fires account for some flame burns in all categories. Gasoline and other flammable substances are often involved in flame burns to adolescents and young adults. Smoking materials are often involved in flame burns to the elderly, with lighter fluid the substance most often involved. Clothing ignition is a contributing factor to injury severity across all age groups.

Distribution of Other Burns by Age Group*

	0-2	3-8	9-12	13-19	20-44	45-59	60+
Contact	24%	7%	9%	14%	14%	6%	10%
Chemical	3%			6%	9%	6%	3%
Radiation				7%	4%	2%	
Electrical		7%	5%	3%	1%		2%

Age Groups

*Data derived from table on page 1-7.

In terms of burns other than scald or flame, contact burns are highest among the youngest children, followed by adolescents and young adults. Stoves and room heating devices are the most common hot surfaces touched. The chemical burns are most frequent in work-related accidents in the adult populations, with some incidence among toddlers who touch or swallow these substances without recognizing the danger. Radiation burns are typical of adolescents and young adults, and, in this fall and winter sample, are due almost exclusively to the misuse of sun lamps. Electrical burns are the least frequent type of burn in this sample; however, the two typical kinds of electrical burns are represented: those burns from household current, often sustained by young children who put appliance or extension cord joints in their mouths, and those burns resulting from contact with high voltage electricity, often sustained by risk-taking adolescent males or workers who accidentally contact live wires.

Educational Diagnosis

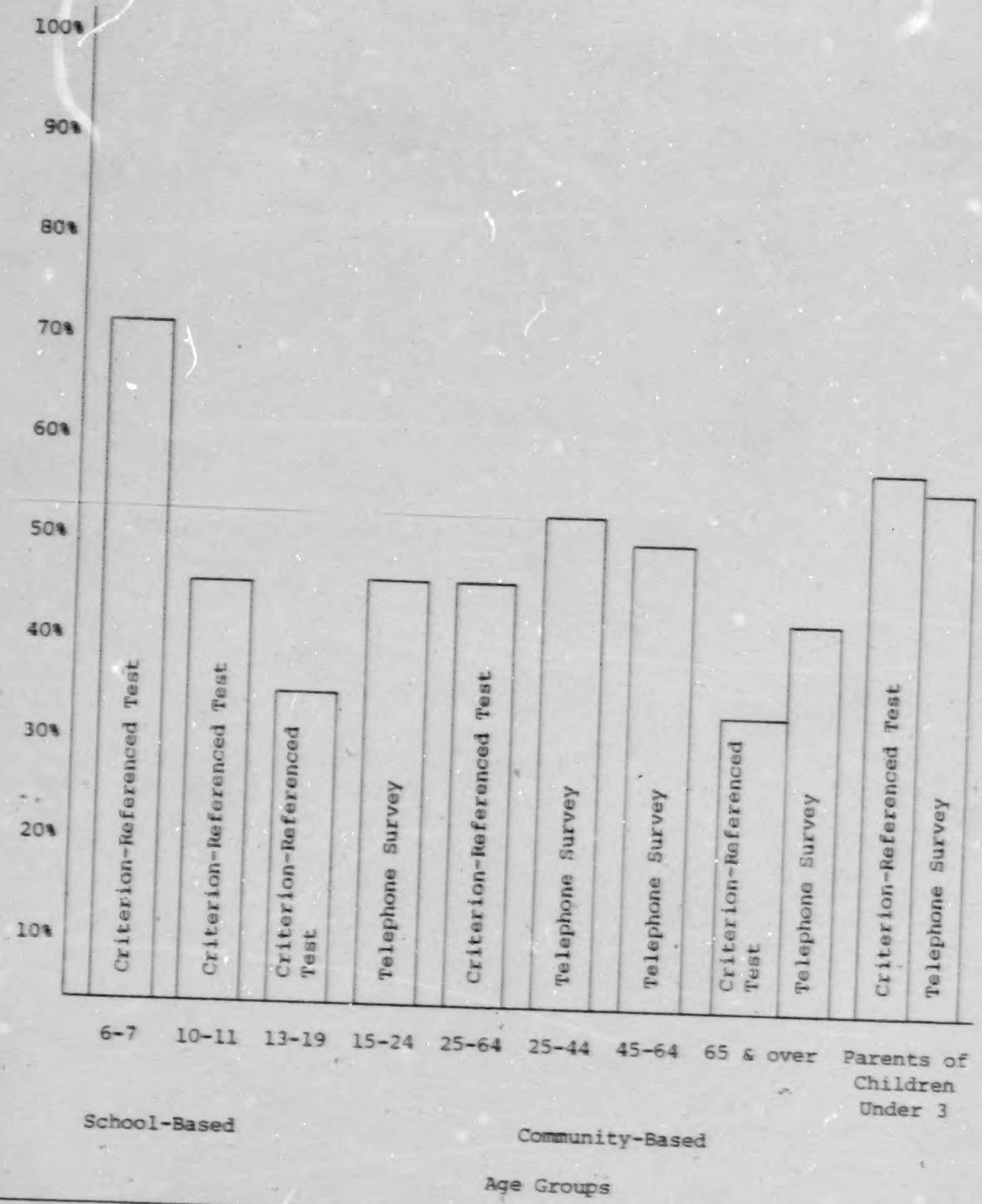
The purpose of the educational diagnosis is to determine how much and what kinds of information people have about fire and burn prevention. Data were analyzed and presented in several different ways: the overall score of burn prevention knowledge; subscores for type of knowledge (e.g., concepts, preventive behaviors); subscores for type of burn (e.g., flame, scald, contact); and subscores for type of product (e.g., flammable liquids, flammable fabrics, electrical sources). In addition, individual items were analyzed to identify specific knowledge deficiencies and misconceptions. The basic source of information for the school-aged samples was the criterion-referenced tests. Data for adult groups were drawn from both the criterion-referenced tests and a telephone survey.

How Much Do People Know About Burn Prevention?

An examination of the range of overall scores (expressed in terms of average percent correct) indicates that they are rather low for most age groups, with the exception of primary school children. Most people tend to answer only one out of every two or one out of every three questions correctly, suggesting perhaps that burn/fire prevention knowledge is not extensive. Keeping in mind that different test versions were used for each group, we find that in comparing the overall scores across age groups, the elderly and adolescents score critically low. Scoring somewhat higher are: adults in general, parents of children under 3 and middle-school children. First graders do much better than the rest. That is, they successfully accomplish a large percentage of the objectives set forth as necessary for them.

OVERALL SCORE FOR AGE GROUP

(Average % Correct)



In looking at the overall knowledge scores (criterion-referenced tests) of those groups which appear to be at highest burn risk, in the Boston SMSA we find low scores for adolescents (32%) while parents of children under 3 score somewhat higher (54%). However, we have reason to believe that the parent sample is skewed in the direction of a higher socioeconomic status. Although burn victims among the elderly are slightly underrepresented, they not only have the lowest scores (30%) but have by far the highest fatality rate from burn injuries. Of those burn victims who are in direct proportion to the population, the primary school children do exceedingly well (72%) while the general adults do only fairly well (44%). Middle school children, who are the most underrepresented, score in the middle range.

What Type of Knowledge Do People Have About Burn Prevention?

Generally all age groups score lowest on knowledge of the basic facts, concepts or principles underlying the burn problem, for example, combustion, flammability of liquids and clothing, and electrical conductivity; knowledge of appropriate behaviors to minimize harm once a fire or burn is in progress ranks highest (except for primary school children), including such reactions as dropping and rolling to extinguish burning clothing and putting cold water on a burn. General awareness of the causes and consequences of burn injuries and knowledge of appropriate preventive behaviors cluster third and fourth with some minor exceptions to this ranking order. For example, on the criterion-referenced tests, the elderly score very low (22%) in knowledge of the causes and consequences of burns.

SUBSCORES FOR TYPE OF KNOWLEDGE BY AGE GROUP

(Average % Correct)

Criterion-Referenced Test	Facts and Concepts	General Awareness of Causes and Consequences	Appropriate Preventive Behaviors	Behaviors to Minimize Harm Once a Fire or Burn Is in Progress
Age Group:				
Primary (6-7)	58%	81%	73%	64%
Middle (10-11)	40%	49%	45%	57%
High School (13-19)	28%	34%	42%	42%
25-64	44%	53%	56%	76%
65 & Over	37%	22%	35%	63%
Parents of Children Under 3	47%	55%	57%	72%
Telephone Survey				
15-24	48%	45%	37%	55%
25-44	45%	49%	43%	59%
45-64	43%	47%	40%	59%
65 & Over	36%	42%	36%	47%
Parents of Children Under 3	53%	48%	42%	58%

What Is the Extent of Knowledge About Each Type of Burn?

For nearly all age groups, scores for knowledge of electrical burns are quite low. People do somewhat better on knowledge of scald and flame burns, though most range from only 30 to 50% correct. Lowest scores belong to teenagers and the elderly.

SUBSCORES FOR TYPE OF BURN BY AGE GROUP

(Average % Correct)

Criterion-Referenced Test

Age Group	Scald	Flame	Contact	Electrical
Primary	77%	76%	78%	50%
Middle	30%	52%	47%	46%
High School	37%	32%	—	26%
25-44	63%	51%	—	57%
45-64	—	—	—	—
65+	53%	32%	46%	28%
Parents of Children Under 3	63%	53%	—	59%

Telephone Survey

Age Group	Scald	Flame	Contact	Electrical
15-24	37%	42%	20%	7%
25-44	43%	46%	18%	5%
45-64	42%	44%	19%	5%
65+	33%	38%	12%	4%
Parents of Children Under 3	42%	45%	16%	6%

Interestingly, parents of children under 3 seem to know a good deal about scalds (63%), but children, ages 0 to 2, suffer the highest incidence of that type of burn injury. Also, although the primary school children do quite well in identifying sources of scalds (77%), they too are burned very often in that way. This suggests that perhaps factors other than knowledge are contributing to the injury.

As previously mentioned, flame burns, which tend to increase in frequency with age of patient, are accompanied by lower knowledge scores in respondents in their teens and older. This is particularly true for adolescents and the elderly.

Knowledge scores related to contact burns were not available in the diagnosis for groups at higher risk from contact burns. Knowledge related to electrical burns tends to be very low for groups which appear to be at the highest risk.

What Is the Extent of Knowledge About Products Involved in Burn Injuries?

As the chart below indicates, people know least about electrical sources and flammable liquids, while middle and high school students score very low on flammable fabrics as well.

SUBSCORES FOR TYPE OF PRODUCT BY AGE GROUP

(Average % Correct)

Criterion-Referenced Tests

Age Group	Electrical Sources/ Appliance Cords	Fireplaces	Flammable Liquids	Flammable Fabrics	House Fires	Matches and Smoking Materials	Ovens and Ranges	Space Heaters
Primary	50%	81%	60%	59%	72%	88%	91%	62%
Middle	58%	34%	53%	28%	55%	51%	50%	52%
High School	24%	—	31%	30%	47%	56%	33%	31%
25-44	52%	—	45%	59%	71%	84%	64%	70%
45-64	—	—	—	—	—	—	—	—
65+	23%	—	14%	43%	42%	42%	41%	—
Parents of Children Under 3	54%	—	46%	63%	75%	80%	66%	71%

What Are the Specific Knowledge Deficiencies and Misconceptions?

Scald Burns

Among high risk groups, children in the primary grades are aware of neither the potential severity of scalds nor their sources (such as bath water). Parents of children under 3 generally know about scalds but do not realize how vulnerable children in this age group are to them. Such factors as fatigue, inattention, stress, distraction and haste--all important factors described in the profile data for scalds--were mentioned by very few people as potential contributors to burn injuries in the kitchen scenes presented in the educational diagnosis.

In addition, most members of age groups ranging from adolescence to old age (excluding parents of children under 3) are unaware of the proper first aid treatment for scald burns.

Flame Burns

The elderly often suffer severe injuries while smoking in bed or in overstuffed chairs, or while using matches and cigarette lighters. In the case of flammable liquids, the elderly are generally unaware of risks associated with storing aerosol cans near heat. They are unfamiliar with measures that can be taken to prevent lighter fluid injuries, and do not know that fumes themselves can ignite. Since over half of the injuries to the elderly result in clothing ignition, this group's lack of knowledge about the burning speed of various fabrics and their inability to recognize situations that present a risk of clothing ignition, seem to be important causal factors.

Adolescents, who are also at risk from flame, are generally unaware of the properties of flammable liquids and of correct procedures for their storage and use. They are not aware of the increased severity of the burn when clothes are involved; of relative burning speeds of different fabrics; of safe, appropriate styles of clothing; of current regulations on flammability of fabrics; or of proper maintenance of flame-resistant fabrics.

Knowledge deficiencies related to flame burns among the adult population in general parallel the deficiencies for both adolescents and the elderly. The profile data suggest that the incidence patterns for younger adults (20 to 44) are more closely aligned with adolescents, while older adults (45 to 59) are aligned with patterns among the elderly.

Flame burns to children in the 3- to 8-year age group are caused frequently by house fires or by the children's playing with matches or lighters when an adult is not present. Some experimentation by boys with flammable liquids is evident. Clothing ignition often results. Three- to eight-year-olds in this sample cannot identify the appropriate action to take if caught in a house fire. Children in this age group report that they are rarely taught to light matches, but learn how from other children suggesting that proper procedures should be taught by adults. They know they can be burned by touching the flame of matches and cigarette lighters, but are unaware of the danger of setting their clothing on fire. They mistakenly believe that clothing protects them. They cannot identify safe clothes to wear while cooking or helping around the stove. Very few can distinguish between flammable and nonflammable liquids, except for gasoline.

Although 9- to 12-year-olds do better on knowledge of flame burns than scald burns, they appear to have deficiencies similar to the adult groups mentioned above. With regard to behaviors to minimize harm caused by flame burns, it is interesting to note that except for the 3- to 8-year-olds all age groups score HIGH (over 85% correct) on knowledge of the drop-and-roll technique for extinguishing clothing on fire. Yet when on fire, profile data indicate that few people employ this technique. This suggests that an educational campaign should provide opportunities to practice such behaviors. Further, primary school children and adolescents do not know about applying cold water to flame burns.

It appears that basic knowledge deficiencies are very much the same across groups. This suggests that many of the same messages are pertinent to all age groups, though they may be delivered through different materials and strategies. The incidence patterns reveal special problems for different age groups which must be addressed in the educational intervention. These include: decreased agility for the elderly; risk-taking behavior for preadolescents and adolescents; and the disability of alcoholism for adults.

Electrical Burns

Young children (3 to 8), at risk from disfigurement to the mouth from electrical burns, know little about electrical conductivity and unsafe electrical connections. Preadolescents and adolescents do not identify the potential hazards involving extension cords and are not familiar with basic principles of conductivity and grounding. In general, adolescents and adults do not recognize extension cord joints as potential hazards to young children nor do they see the dangers to themselves of electricity arcing from high tension wires. Although parents of 0- to 2-year-olds are aware of electrical hazards to young children, they do not understand that chewing or sucking on extension joints leads to burn injuries more often than does sticking metal objects in wall sockets.

Is Knowledge Related to Selected Sample Characteristics?

Overall scores for each age group were compared to selected characteristics describing the sample, such as sex, age, socioeconomic status, etc. In general very few statistically significant relationships emerged, but interpretation of the tests of significant data must be treated cautiously due to the variability of the size of the subsamples. There is a tendency in the younger groups (primary, middle) for the boys to score slightly higher than the girls, but, beginning with adolescents, this pattern reverses itself.

The higher socioeconomic income groups score somewhat higher than the lower groups. Surprisingly those people reached through the educational diagnosis, who reported that they had been burned at some time in their lives, do not appear to score any higher than those who report no previous burn experience. However, in almost all cases there is a tendency for those who had been mildly burned to do just a little better than those who had been severely burned or not at all.

How Does the Experimental Site Compare to the Control?

Comparisons of overall scores of the experimental and control groups revealed small but statistically significant differences for each age group except middle school children. Data and detailed discussion of these comparisons can be found in Appendix A.

Conclusions of Research Findings and Implications for Educational Intervention

During Phase I of the Burn Injury Education Demonstration project, a comprehensive needs assessment was conducted to determine the patterns of burn accidents, profiles of burn victims, and the current state of knowledge, deficiencies and misconceptions with regard to the prevention and emergency treatment of burn injuries. The two major research activities were: the collection of burn data and the educational diagnosis.

The project staff have drawn six major conclusions about the implications of research findings for an educational campaign.

#1

A BURN PREVENTION CAMPAIGN MUST ADDRESS THE PROBLEM OF SCALDS BECAUSE OF THE HIGH INCIDENCE RATE, AND THE PROBLEM OF FLAME BURNS BECAUSE OF THE SEVERITY OF INJURY. OTHER TYPES OF BURNS SHOULD BE ADDRESSED FOR SPECIFIC AGE GROUPS, DEPENDING ON CONSIDERATIONS OF CONSUMER INTEREST AND AGE-RELATED RISK AND SEVERITY FACTORS.

Supportive Research Findings

Scald and Flame Burns

Scalds account for 42% of the state burn reports, while flame burns, the second most frequent burn (26%), tend to be the most severe. From the state reports, the five burn victims reported as dead on arrival were flame burn victims; flame burns were the only burn type that required hospitalization for over half of the reported cases.

In the educational diagnosis, all respondents tended to score higher on scald items than on flame items, suggesting perhaps that factors other than knowledge (haste, stress, distraction) contribute to the scald injury.

The remaining state burn reports (32%) were distributed among other types of burns: contact, chemical, radiation, and electrical burns. They should be considered in age-specific campaigns as follows.

Electrical Burns

For children under the age of 8, the danger of electrical burns is related to child development behavior. Young children, particularly toddlers who tend to put things in their mouths, are in danger of sucking on connecting joints of extension cords. Slightly older children use their teeth to gain strength and leverage and may use their teeth to pull an extension cord apart from an appliance cord. Both behaviors result in severe electrical burns of the mouth.

Among preadolescents and adolescents, risk-taking behavior motivates boys in particular to climb high voltage electrical towers or to explore transmitter stations. Both activities can lead to severe or fatal electrical burns.

The educational diagnosis revealed widespread ignorance across all age groups about electricity and electrical burns.

Contact Burns

Young children, especially during the months when they are crawling and learning to walk, sustain contact burns in many ways. They may try to use a hot surface for balance, for example, or touch a hot object out of curiosity.

Chemical Burns

Adults and adolescents are subject to chemical burns, which are often incurred while working around automobiles (car battery acid) or in work-related accidents.

Children under 3 are also a risk group for chemical burns through ingestion, with an etiology similar to that of childhood poisonings.

Radiation Burns

These tend to occur to adolescents and young adults through the misuse of sun lamps. Sunburns can also be a minor problem for all age groups during the summer months.

#2

THERE ARE PREDOMINANT THEMES THAT SHOULD BE EMPHASIZED IN BURN PREVENTION EDUCATION. YET CARE MUST BE TAKEN TO ADDRESS SPECIFIC SITUATIONS AND AGE-RELATED RISKS, RATHER THAN TO BROADCAST VAGUE GENERALIZATIONS AND FEAR-PROVOKING MESSAGES.

Supportive Research Findings

The burn victim profile data indicate that the pattern of flame burns is different for each age group. For example, preschoolers and primary school children are at risk from house fires and match play; preadolescents, adolescents, and young adults are at risk from the use of gasoline and the improper lighting of gas stoves; and the elderly are at risk from smoking materials. However, the educational diagnosis reveals that the knowledge deficiencies are very much the same across age groups.

These findings suggest that many of the same messages are pertinent to all age groups, although the delivery should be adapted appropriately to age differences.

Some examples of basic messages for the educational campaign include:

- Clothing ignites, not protects.
- Apply cold water immediately to a burn.
- Scalds happen when people are hurrying, distracted, or angry.
- Electric lines and cords look harmless, but carry deadly power.

Special age-related considerations include:

- Elderly persons must compensate for decreased agility.
- Alcoholism leads to disability among adults.
- Preadolescents and adolescents engage in risk-taking behavior.
- Young children need constant supervision.

#3

BURN SAFETY MESSAGES SHOULD BE AGE APPROPRIATE AND ACTION ORIENTED. MEASURABLE BEHAVIOR CHANGE SHOULD BE A PRIMARY GOAL.

Supportive Research Findings

One distressing finding in the educational diagnosis was that all respondents except 3- to 8-year-olds knew to "drop and roll" in the event of clothing ignition, yet victims of all ages tended to react by screaming and running. They were dependent upon bystanders to put out the flames. The education program must grapple with an age-old dilemma of all educators: What is the relationship between knowledge and behavior? And what motivates a person to change behavior?

One possible approach is to suggest actual activities that accomplish needed changes. Examples of such activities are:

- Have children plan and conduct a home fire drill.
- Award certificate to those families who have actually held such a drill at night.
- At school, have each child make a sturdy rope ladder.
- In gym class, teach safe climbing procedures, then allow children to take the ladders home to store near a window in case of fire.

#4

THE EDUCATIONAL DIAGNOSIS REVEALED A TREND FOR FEW STATISTICALLY SIGNIFICANT DIFFERENCES ACCORDING TO SELECTED SAMPLE CHARACTERISTICS (RACE, INCOME, SEX, SCHOOL DISTRICT, SOCIOECONOMIC FACTORS) AMONG ALL RESPONDENTS. THEREFORE, THE EDUCATIONAL CAMPAIGN SHOULD AIM TO REACH THE BROADEST POSSIBLE RANGE OF SOCIOECONOMIC GROUPS.

Supportive Research Findings

Among the adults and school children who took the criterion-referenced tests or were interviewed, very few significant relationships occurred between knowledge and age, sex, socioeconomic status, or income level.

Among the respondents to the telephone survey, there were also no statistically significant differences to be found according to sex or previous burn history. There was a slight tendency for scores to rise with income, and age did feature as a significant factor, with the highest scores earned by the 35-to-44 age group and the lowest by the elderly, 65 and over.

#5

BURN INJURY RISK GROUPS SHOULD NOT BE APPROACHED IN ISOLATION FROM ANOTHER BUT AS INTERACTING MEMBERS OF FAMILIES. MESSAGES ADDRESSED TO EACH AGE GROUP CAN BE CARRIED BY DIFFERENT FAMILY MEMBERS ACROSS GENERATIONS.

Supportive Research Findings

Among very young children who are scald victims, it is not uncommon to find that the child's usual caretaker was not responsible for the child at the time of the accident. It is clear that people other than parents of young children--caretakers from other age groups as well--need to know how to prevent scald accidents to young children.

Indeed, each age group should know how to prevent burn injuries for all age groups. Members of the young adult population (20 to 44) have responsibilities for children, adolescents, and parents over 60 years of age. Adolescents have younger siblings and work as baby-sitters. They may have parents who have an alcohol disability or grandparents who are handicapped in some way. Grandparents often care for young children. Thus, materials developed for one age group should carry messages for other age groups. The materials should be appropriate for use by more than one group. For example:

- Materials for high school students can be equally appropriate for young adults.

- Materials for middle school children can carry messages and promote activities that benefit the children's homes and communities, as children of this age tend to be good social advocates.

#6

PEOPLE TEND TO RESPOND TO MESSAGES THAT ADDRESS WAYS THEY CAN PROTECT OTHER PEOPLE, RATHER THAN THEMSELVES. PEOPLE WILL OFTEN IGNORE PRECAUTIONS TO KEEP THEMSELVES SAFE, YET WILL TAKE GREAT CARE TO PROTECT OTHERS.

Supportive Research Findings

Among all burn victims interviewed, no age group emerged as particularly adept at "drop and roll" when their own clothing ignited. It is heartening, however, to find several cases where bystanders responded appropriately to clothing ignition in others. Obviously, burn knowledge paid a rich dividend when others were involved.

For preventive measures, as well as emergency first aid for burns, the educational campaign will stress procedures people can learn and practice for the sake of others. The underlying assumption will be that this awareness and behavior will also aid the "caretaker" when he or she is in danger.

Methodology
Phase I 1975-76

This report describes the results of activities carried out in Phase I. Data are organized by age group within two spheres of activity.

Burn Injury Data	Educational Diagnosis
Children	
0-2	primary school
3-8	middle school
9-12	high school
13-19	
Adults	
20-44	general adult sample (15-64)
45-59	parents of children under 3
60 and over	elderly sample (65 and over)

Burn Injury Data

To learn about prevailing burn injury patterns within all age groups, we organized our research around the following general questions:

> Who is burned? (e.g., sex, socioeconomic factors, race, family size)
>
> How frequently do different types of burn injury occur within specific age groups?
>
> How severe are different types of burn?
>
> What consumer products are involved?

How do such factors as time, place, and behavior affect patterns of injury?

How did the victim behave before, during, and immediately after the burn accident? Was the reaction appropriate?

From what sources did the victim learn what to do, what not to do?

What preventive behaviors does the victim now take to avoid being burned?

Educational Diagnosis

To learn what people in general (not necessarily burn victims) know about burn/fire prevention, and to see what relationship existed between knowledge and behavior, we asked:

What do people know about burn prevention?

What are the information-seeking habits of each group?

What knowledge do people have about underlying facts and concepts, causes and consequences of burn injuries, appropriate behaviors to prevent harm, and behaviors to minimize harm once a burn or fire is in progress?

What do people know about: prevention of specific types of burn (e.g., scalds, flame, electrical, contact); specific products that may be involved (e.g., flammable fabrics and liquids, matches/smoking materials, appliance and extension cords, ovens/ranges)?

What behaviors do people report they practice for personal burn safety?

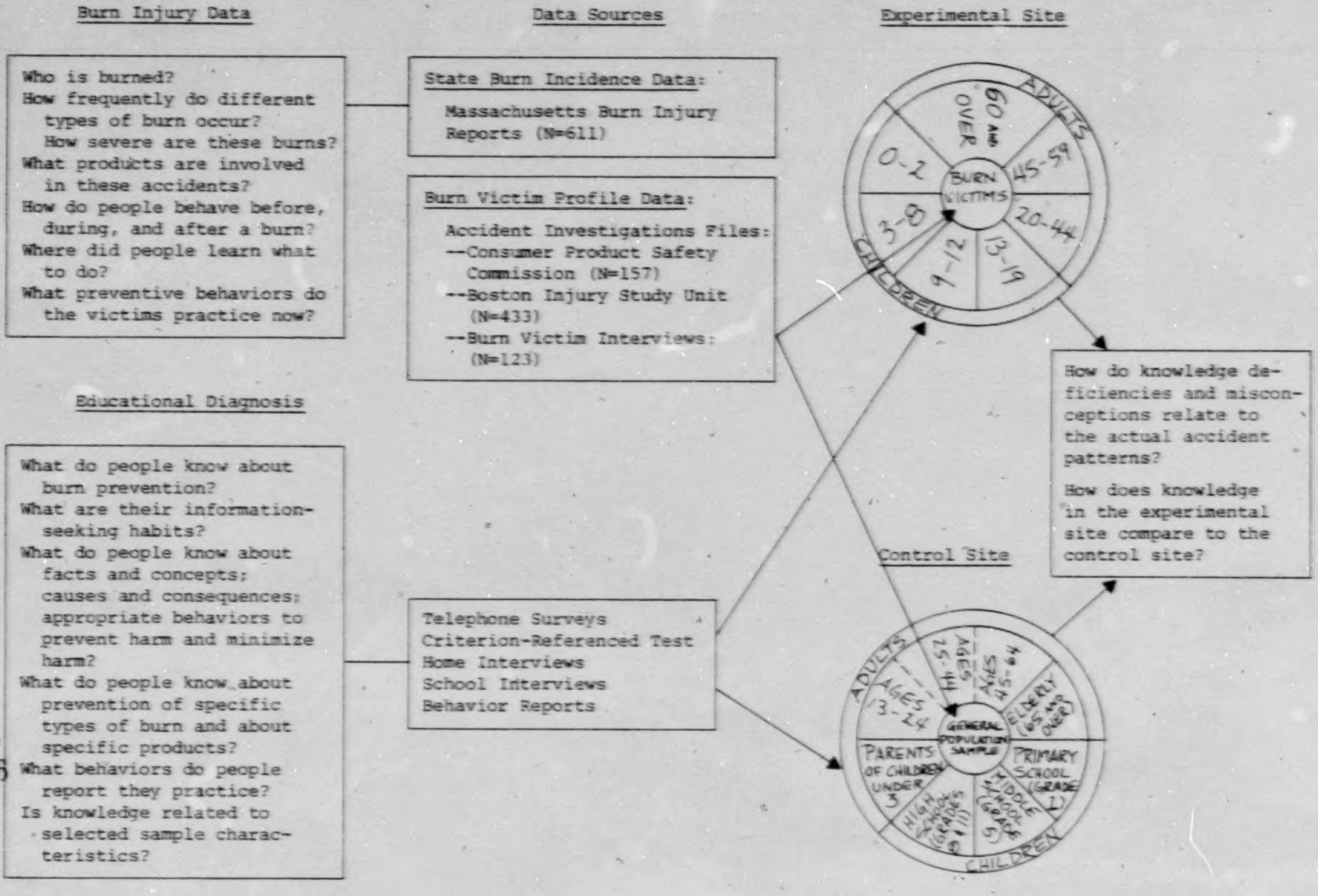
How do knowledge deficiencies and misconceptions compare to actual accident patterns?

Is knowledge related to selected sample characteristics?

How does knowledge in the experimental site compare to that in the control site?

The following chart presents the relationship between the incidence data and educational diagnosis.

PHASE I: BURN INJURY EDUCATION DEMONSTRATION PROJECT


ADULTS
60 AND OVER
45-59
20-44
BURN VICTIMS
0-2
3-8
9-12
13-19
CHILDREN
ADULTS
AGES 13-24
AGES 25-44
AGES 45-64
ELDERLY (65 AND OVER)
GENERAL POPULATION SAMPLE
PARENTS OF CHILDREN UNDER 3
PRIMARY SCHOOL (GRADE 1)
HIGH SCHOOL (GRADES 11 + 12)
MIDDLE SCHOOL (GRADE 5)
CHILDREN

Burn Injury Data

- Who is burned?
- How frequently do different types of burn occur?
  - How severe are these burns?
- What products are involved in these accidents?
- How do people behave before, during, and after a burn?
- Where did people learn what to do?
- What preventive behaviors do the victims practice now?

Educational Diagnosis

- What do people know about burn prevention?
- What are their information-seeking habits?
- What do people know about facts and concepts; causes and consequences; appropriate behaviors to prevent harm and minimize harm?
- What do people know about prevention of specific types of burn and about specific products?
- What behaviors do people report they practice?
- Is knowledge related to selected sample characteristics?

Data Sources

State Burn Incidence Data:

Massachusetts Burn Injury Reports (N=611)

Burn Victim Profile Data:

Accident Investigations Files:
- --Consumer Product Safety Commission (N=157)
- --Boston Injury Study Unit (N=433)
- --Burn Victim Interviews: (N=123)

Telephone Surveys
Criterion-Referenced Test
Home Interviews
School Interviews
Behavior Reports

Experimental Site

Control Site

How do knowledge deficiencies and misconceptions relate to the actual accident patterns?

How does knowledge in the experimental site compare to the control site?

Tasks Accomplished in Phase I

The time line on the following page outlines the tasks accomplished in 1975-76. Project staff:

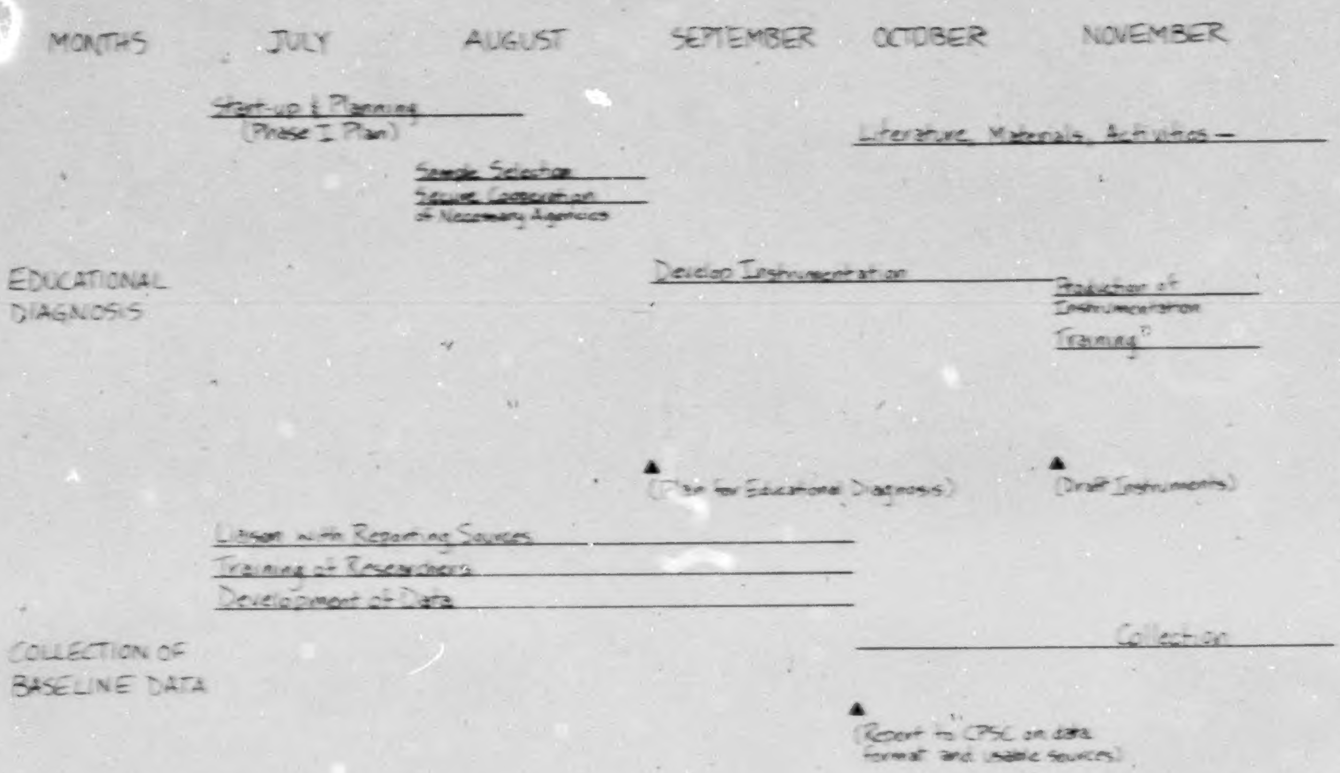
- Conducted extensive literature and case history searches.
- Established liaison with the Massachusetts Department of Public Health.
- Developed a new Massachusetts State Reporting Form.
- Designed an injury code and coding format enabling computerization of injury reports from a variety of sources.
- Collected and analyzed incidence data.
- Established priority educational goals and messages.
- Developed and pilot tested instruments.
- Administered tests and analyzed educational diagnosis data.
- Prepared a midproject report.

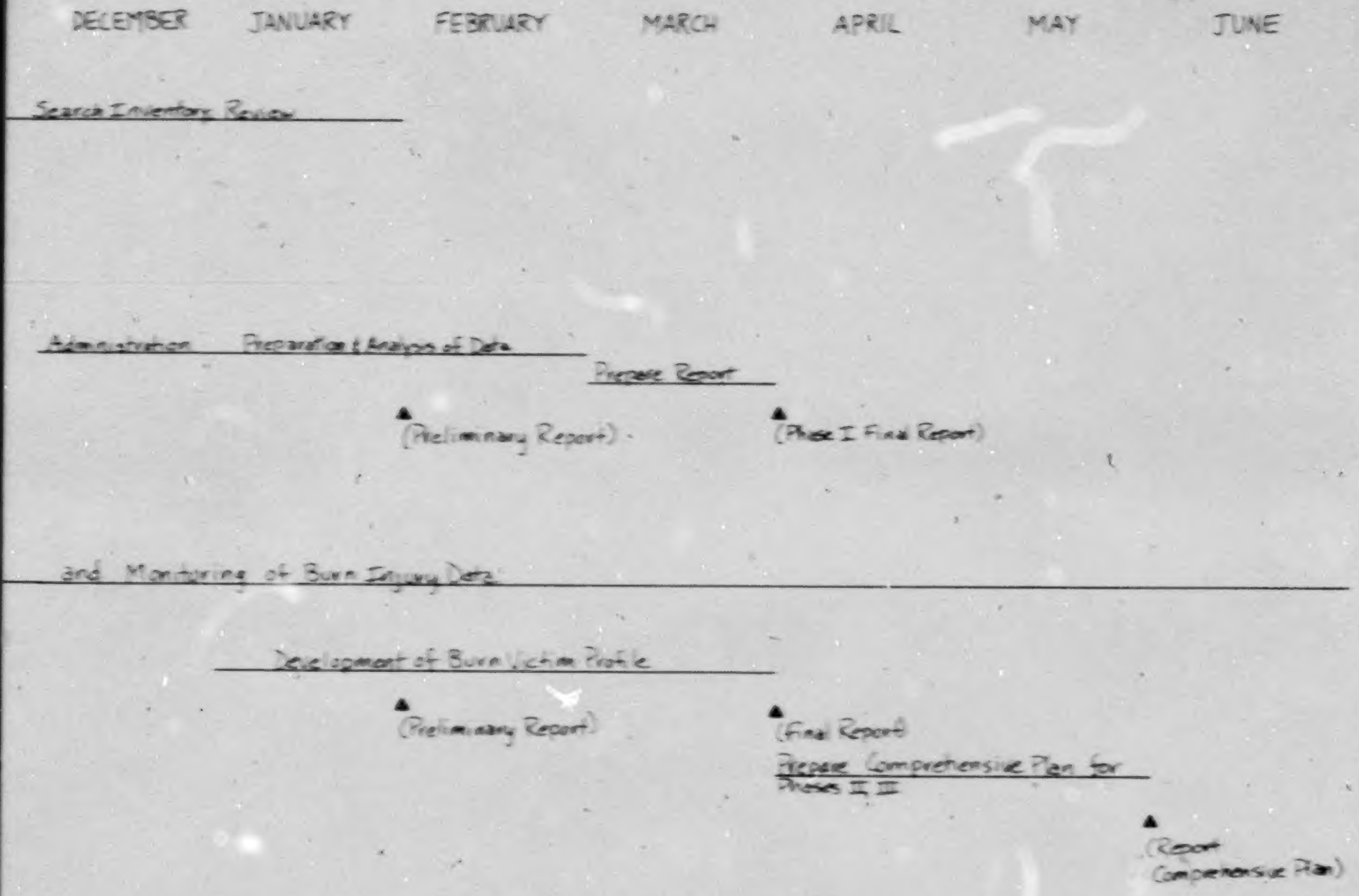
Two problems occurred in carrying out the tasks.

1. The rate of hospital compliance with the Massachusetts Department of Public Health law stipulating that all burn injuries over 5% total body surface be reported is low.
2. Gaining access to a sufficient and therefore unbiased sample of parents of children under 3 and of elderly people across the Boston-Springfield Standard Metropolitan Statistical Area (SMSAs), using random-sampling procedures, proved difficult.

As a result of the first problem, a feasibility study is being conducted to assess the possibility and cost of exacting data directly from hospital records. To solve the second problem, parents of children under 3 were finally reached through health facilities in two selected communities, and a group of elderly respondents were contacted through two housing facilities built especially for them.

PHASE I


MONTHS
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
Start-up & Planning
(Phase I Plan)
Literature, Materials, Activities —
Sample Selection
Secure Cooperation of Necessary Agencies
EDUCATIONAL DIAGNOSIS
Develop Instrumentation
Production of Instrumentation
Training
(Plan for Educational Diagnosis)
(Draft Instruments)
Liaison with Reporting Sources
Training of Researchers
Development of Data
COLLECTION OF BASELINE DATA
Collection
(Report to CPSC on data format and usable sources)



DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
Search Inventory Review
Administration
Preparation & Analysis of Data
Prepare Report
▲ (Preliminary Report)
▲ (Phase I Final Report)
and Monitoring of Burn Injury Data
Development of Burn Victim Profile
▲ (Preliminary Report)
▲ (Final Report)
Prepare Comprehensive Plan for Phases II, III
▲ (Report Comprehensive Plan)

Burn Injury Data

Burn injury data were collected to determine the types and severity of burn injuries that occur in the general population. As noted, the general population was divided into "risk groups" as follows.

Children:	Adults:
younger than 3 years	ages 20-59
ages 3-8	over 60
ages 9-12	
ages 13-19	

Specifically, the data address the following questions.

To whom do the injuries commonly happen? What emerges as the victim profile in terms of:

- age?
- race?
- employment status?
- education?
- type of household?
- number of siblings?
- marital status?

What types of burn occur most frequently: Scald? Flame? Contact? Electrical? Chemical? Radiant Heat?

How severe are the different types of burn with respect to:

- medical care?
- length of hospital stay?
- extent of burn?

What consumer products are involved?

How do the factors of time, place, and behavior affect the patterns of accidents?

Time

- month of year
- day of week
- time of day

Place

- general location
- specific location

Behavior

- presence or absence of adult supervision
- number of people involved in the accident
- victim's activity
- victim's response
- bystander's response
- disability

What problems are associated with the collection of burn injury data?

This final report presents burn injury data in two distinct formats.

1. State burn incidence data, derived solely from burn reports received from the Massachusetts Department of Public Health.

2. Burn victim profile data, derived from three sources:

   - Accident investigations conducted by the U.S. Consumer Product Safety Commission (CPSC), Boston area office.

   - Accident investigations conducted by the Boston Injury Study Unit (BISU).

   - Burn victim interviews conducted by project staff.

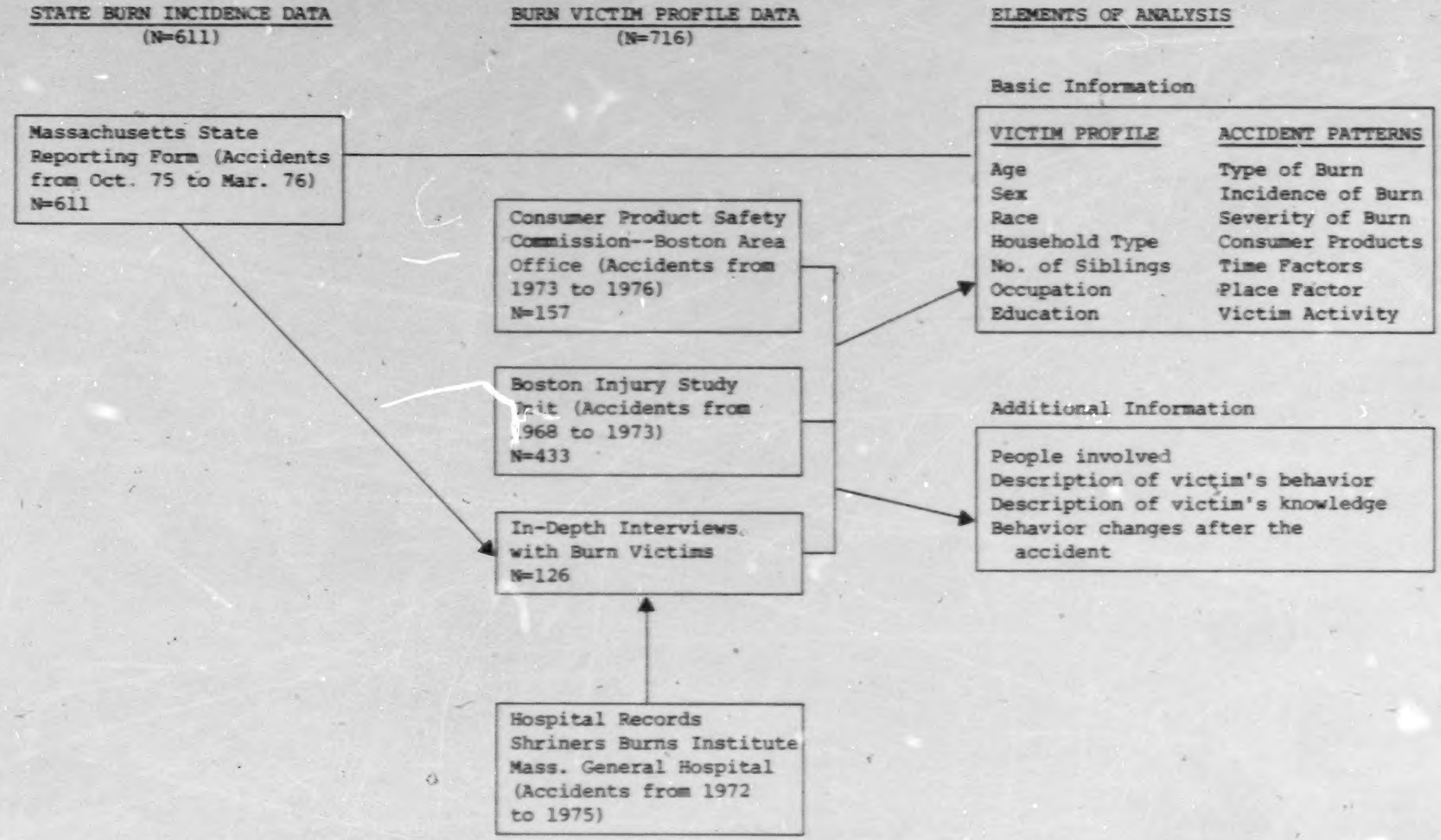
The distinctions between the two sets of data, outlined in the following tables, are based on the nature, source, and content of the information; the time period of the accident; data limitations; and the purpose for which data were used in this report.

DISTINCTIONS BETWEEN TWO TYPES OF BURN INJURY DATA

	STATE BURN INCIDENCE DATA	BURN VICTIM PROFILE DATA	
SOURCE	Massachusetts burn injury reports.	In-depth accident investigations.	Burn victim interviews.
RECORDER OF INFORMATION	Hospital personnel, often emergency ward staff.	Injury investigator.	Project staff researcher.
ACCIDENT TIME PERIOD	Between October 1, 1975, and March 31, 1976.	Between 1968 and 1976.	Between 1972 and 1976.
NATURE OF INFORMATION	Standardized report of burn accident, required by law to be filed with Massachusetts Department of Public Health.	Full field investigation of burn accident, filed with federal agencies involved with public health and consumer safety.	Interviews with burn victim/family about events surrounding accident, conducted specifically for project.
LEVEL OF DETAIL	Basic identification of victim, information about accident, and severity of injury are required on report.	Full detail on victim, circumstances of accident, identification of products involved, extent and severity of injury, length of hospital stay, patient disposition.	Full detail on victim, circumstances of accident, behavioral responses of victim and bystanders, first aid, previous instruction on burn safety, changes made to prevent recurrence.
RESIDENCE OF VICTIM	Boston SMSA, 58%. Springfield SMSA, 2%. Rest of Massachusetts, 36%. Out of state, 4%. (All received medical care in Massachusetts.)	Boston SMSA, 100%.	Boston SMSA, 100%.
LIMITATIONS OF DATA	Uneven compliance with law by reporting and nonreporting hospitals; just fall and winter accidents reported; wide variation in details supplied by reporting hospitals.	Priorities and jurisdiction of federal agencies conducting investigations, with certain accidents routinely excluded; mechanisms by which accidents came to agency attention (e.g., selected hospitals contacted, publicity surrounding accident); distance to accident site and availability of agency personnel; no attempt at random selection.	Interviews conducted only when permission was granted by victim/family; 50% of respondents were inpatients at two Boston burn facilities, one for children, one for adults.
USE IN FINAL REPORT	Because data source had least known bias, data were used to establish burn frequencies by age and type of burn.	Because of the nature and fullness of information, data were used to delineate patterns of accidents and burn victim profiles, and to establish relative severity of injury.	

SOURCES OF DATA AND MAJOR VARIABLES COLLECTED FROM EACH SOURCE

BURN INJURY DATA



STATE BURN INCIDENCE DATA
(N=611)

BURN VICTIM PROFILE DATA
(N=716)

ELEMENTS OF ANALYSIS

Massachusetts State Reporting Form (Accidents from Oct. 75 to Mar. 76)
N=611

Consumer Product Safety Commission--Boston Area Office (Accidents from 1973 to 1976)
N=157

Boston Injury Study Unit (Accidents from 1968 to 1973)
N=433

In-Depth Interviews with Burn Victims
N=126

Hospital Records
Shriners Burns Institute
Mass. General Hospital
(Accidents from 1972 to 1975)

Basic Information

VICTIM PROFILE	ACCIDENT PATTERNS
Age	Type of Burn
Sex	Incidence of Burn
Race	Severity of Burn
Household Type	Consumer Products
No. of Siblings	Time Factors
Occupation	Place Factor
Education	Victim Activity

Additional Information

- People involved
- Description of victim's behavior
- Description of victim's knowledge
- Behavior changes after the accident

Data Collection: State Burn Incidence Data

Massachusetts law (1974, c. 122) requires that all burns affecting 5% or more of the body surface area (BSA) be reported to the Massachusetts Department of Public Health (MDPH). The National Fire Protection Association (NFPA) is responsible for collecting burn incidence data in collaboration with MDPH.

Project staff collected and analyzed all burn reports received by MDPH from October 1, 1975 to March 31, 1976. Each month, all reports received by MDPH were given a report number, stripped of patient identification, and sent to NFPA for coding and analysis.

The number of reporting hospitals and the distribution of burn reports, raised questions about hospitals' compliance with the law. The following table presents the distribution of the 611 burn reports received by the MDPH during the six-month data collection period.

Distribution of State Burn Reports
From Reporting Hospitals

Number of hospitals in Massachusetts with emergency room facilities = 112.
Number of hospitals reporting burn injuries = 69.

25 hospitals reported	1 burn
17 hospitals reported	2 burns
7 hospitals reported	3 burns
7 hospitals reported	4 burns
5 hospitals reported	5-9 burns
2 hospitals reported	10-19 burns
3 hospitals reported	20-29 burns
- hospital reported	30-39 burns
- hospital reported	40-49 burns
- hospital reported	50-59 burns
1 hospital reported	60-69 burns
- hospital reported	70-79 burns
1 hospital reported	80-89 burns
1 hospital reported	90+ (183)
69	586*

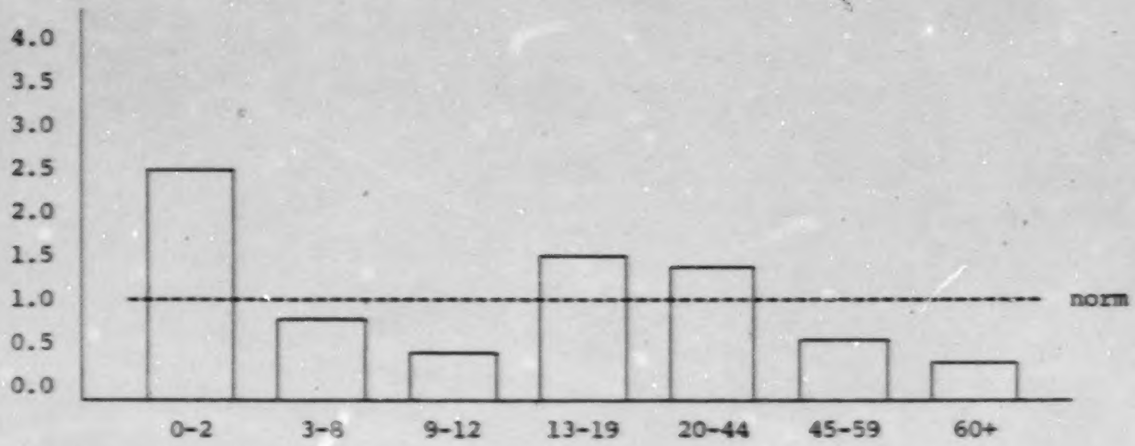
*25 reports from unspecified sources, either hospital or private physician.

Approximately 60% of the potential reporting hospitals submitted a report. Eight hospitals (7% of the potential reporting hospitals) submitted 72% of all reports. Two of these hospitals have specialized burn facilities: they reported only 35 burns, or 6% of all reports. One hospital, reporting 183 burns or 30% of all reports, is an average-sized general hospital within Boston SMSA.

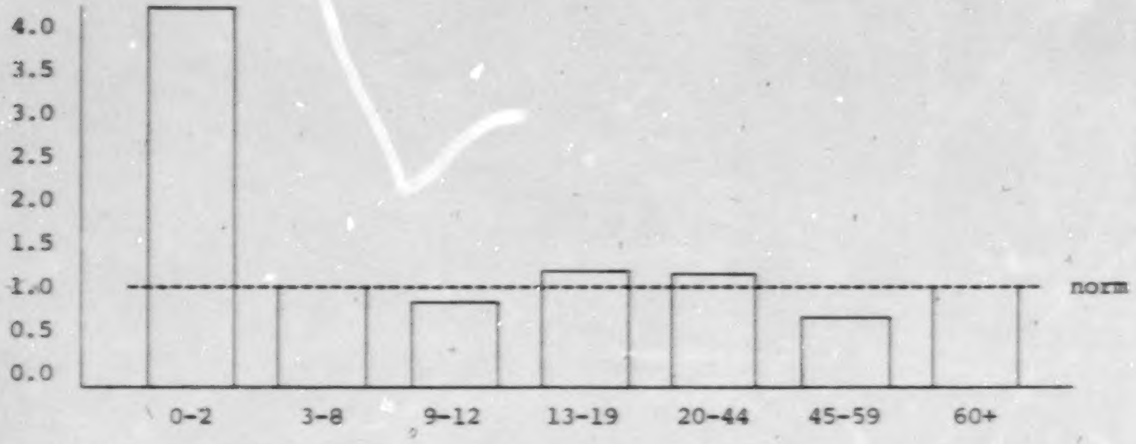
Although this mandatory burn reporting system was originally intended to supply the burn incidence baseline for the project, scattered compliance with the reporting law required that further scrutiny of the data be conducted before a decision was made as to their usefulness for the project.

A data-collection anomaly--one hospital supplied 30% of all reports--allowed for an internal test of the data. At issue was whether the reports from one hospital, reporting close to 100% of its burn cases, would be similar to the remaining, scattered state reports when a particular factor was isolated for study. The factor studied was the distribution-of-burns-by-age group, and the identification-of-age groups that seem to be at greatest risk from burn injuries. For the one hospital's reports, and for all other state reports, reported burn incidence for each age group was compared to "expected incidence." "Expected incidence" is that burn distribution to be anticipated if the distribution-of-burn-injuries-by-age group were exactly parallel to the distribution-of-that-age group in the population (according to the 1970 census). In analyzing the 183 reports from the single hospital, reported burn incidents were significantly different from "expected" incidents: three groups (0 to 2 years, 13 to 19 years, 20 to 44 years) had more burns than expected, and four groups (3 to 8 years, 9 to 12 years, 45 to 59 years, over 60 years) had fewer burns than expected. In performing the same analysis on the other state reports, the results were similar; the same age groups were over- and underrepresented in the burn incidence data. In both cases, results were statistically significant at the .001 level; the figures and table below present the analyses.

Ratio of Reported to "Expected" Burn Incidence
(Comparison Between Two Data Bases)



REPORTS FROM ONE HOSPITAL



ALL OTHER STATE REPORTS

Age Group	One Hospital	All Other State Reports
0-2*	2.15:1	3.70:1
3-8	.94:1	.90:1
9-12	.45:1	.52:1
13-19	1.58:1	1.26:1
20-44	1.34:1	1.02:1
45-59	.62:1	.55:1
60+	.45:1	.69:1

*The big difference in the ratios in the 0-to-2 age group might be explained in part by the fact that two of the eight "high-reporting" hospitals were pediatric facilities, and very young children accounted for the majority of their reports.

The similarity in age distribution of burns between the two sets of data appears to validate their use as one base for the development of an educational program. Nevertheless, project staff have decided to go directly to medical records of hospitals within the experimental and control sites and to test the feasibility of using these records to establish more precisely the project burn-incidence baseline for Phase II.

Data Collection: Burn Victim Profile Data

These data were compiled from three sources:

1. Files of in-depth investigations of burn accidents to residents within the Boston SMSA between 1968 and 1973 conducted by the Boston Injury Study Unit (N = 433).
2. Files of in-depth investigations of burn accidents to residents within the Boston SMSA between 1973 and the present, conducted by the U.S. Consumer Product Safety Commission (N = 157).
3. Project interviews with burn victims residing within the Boston SMSA, whose accidents occurred between 1972 and the present (N = 126).

Data Sources

Boston Injury Study Unit

BISU was a study group funded by the U.S. Department of Health, Education, and Welfare, first through the Public Health Service, and then through the Food and Drug Administration. It investigated accidental injuries in the New England area, and reported findings to federal agencies mandated to regulate consumer products such as flammable clothing. Cases were brought to the attention of BISU through hospital emergency and admitting room personnel. To a lesser extent, cases were discovered by BISU through newspaper accounts, consumer complaints, and agency referrals. Cases were selected by BISU for study according to agency jurisdiction and current priorities. In addition, such factors as availability of investigators, distance to the accident site, and agency work loads influenced case selection; there was no attempt to randomize the selection. With certain types of burns, however, such as those involving clothing ignition, efforts were made to follow up every referral. Industrial and motor vehicle accidents were routinely excluded from the study, as were those from high voltage electricity.

The project coded 433 BISU accident reports of victims residing within the Boston SMSA.

U.S. Consumer Product Safety Commission

CPSC is an independent, federal regulatory agency responsible for consumer safety. Its priorities are closely linked to consumer products, especially those regulated by or under scrutiny by the commission, such as flammable fabrics, household appliances and furnishings, recreational products and toys.

Emphasis on consumer protection determines which burn accidents CPSC investigates. Like BISU, CPSC routinely excludes industrial and motor vehicle accidents.

The project coded 157 cases from CPSC files.

Burn Victim Interviews

Names of possible burn victim interviewees within the Boston SMSA came from:

- Shriners Burns Institute, for burned children population;
- Massachusetts General Hospital, for adult population;
- Massachusetts Department of Public Health burn reports, for burn victims in the general population.

The following table shows the numbers of potential respondents and the number of completed interviews from each of these sources.

SELECTION OF 126 RESPONDENTS

FOR PROJECT INTERVIEWS OF BURN VICTIMS AND FAMILIES

Source	Potential Respondents: In Boston SMSA	Completed Interviews	Initially Agreed But Not Completed	Initially Refused	Unreachable	Response Rate
MASS. GENERAL HOSPITAL (1974-1975)	25	14	3	4	4	56%
SHRINERS BURNS INSTITUTE (1972-1975)	84	47	6	1	30	56%
MASSACHUSETTS REPORTING SYSTEM (Oct. 1975-March 1976)	350	65	8			19%

Sampling Procedures

Massachusetts General Hospital

Acute admission patients residing within the Boston SMSA between July 1, 1974, and October 1, 1975, were considered for interviews. Many MGH patients did not qualify because they were transferred from hospitals outside the SMSA and did not meet our sample requirements. The 25 patients who did qualify were sent a letter from the Chief of the Burn Unit requesting permission for an interview. The patient could indicate his or her decision on an enclosed, stamped, self-addressed post card.

Shriners Burns Institute

Only acute admission patients who resided within the Boston SMSA and were burned between September 30, 1972, and September 30, 1975, were considered for interviews. A total of 84 patients qualified. As project staff were already acquainted with many of these families, initial contact requesting permission for the interview was made by phone whenever possible. Families labeled "unreachable" could not be contacted by letter or telephone, or the survivors could not be reached, or social service recommended that they not be included in the study. Specifically, families who were suspected of child abuse, who were hostile to any intervention, or were under extreme stress were eliminated for fear a project interview might jeopardize the work of social service.

Massachusetts Department of Public Health

During the time when project staff were collecting and analyzing burn reports (October, 1975 through March, 1976), MDPH routinely sent letters to all reported burn victims within the Boston SMSA requesting permission for an interview. The patient could indicate his or her decision on an enclosed, self-addressed post card. Sixty-five interviews were completed, 49 conducted by project staff and sixteen by CPSC investigators.

Instrumentation

The in-depth investigations on file with BISU and CPSC were reported on standard forms developed by each agency. The project's interview form (see Appendix D) was modeled after the CPSC forms (both the standard accident investigation form and the flammable fabrics supplement). Added to this basic form were questions about the behavior of the victim and bystanders before, during, and after the emergency. Information was sought about first aid treatment, previous experience with burn injuries, and sources of burn safety information that had proved helpful during the incident.

Coding

To code the data, the project developed a manual that provides code categories for various victim activities, divided according to the six major types of burn: scald, flame, contact, chemical, radiation, electrical (see Appendix C). Supplemental manuals were prepared for use with the state burn reports, and with the in-depth investigations and interviews.

Administration of Instruments

Two interviewers were hired and trained by experienced investigators to interview the burn victims. Training was based on what current literature and field experience indicate to be the dimensions and characteristics of the burn injury problem, and on factors contributing to effective and sensitive interviews of accident victims. The project director supervised the interviewing.

Each interview was conducted in the victim's home, at a time mutually convenient to patient and interviewer. The interviews lasted about an hour. The interviewer then completed the interview form and submitted the report to the project staff.

Four coders were hired and trained to use the coding manuals, and to translate the state burn reports, interviews and in-depth investigations onto code sheets.

Data Analysis

All data were keypunched and analyzed by computer. Frequencies and crosstabs were run as appropriate, for both sets of data. Chi-square analysis was performed on the state burn report data.

Problems Associated with Collection of Burn Data

State Burn Incidence Data

The project determined that it was possible to use the state data to make recommendations for educational intervention. However, these data did not provide accurate, reliable numbers on burn occurrences in the experimental and control sites for the following reasons:

- The number of reports filed by individual hospitals varied enormously.
- Interpretations of what is a reportable burn varied greatly among hospitals--a large percent of burns reported actually affected less than 5% body surface area.
- A spot check of a hospital reporting fewer than ten

burns in a two-year period revealed records of 110 hospitalized burn patients during that period.

- The control site reported only 2% of the burn injuries.

Project staff attempted to increase and improve reporting procedures by:

- revising the reporting form. NFPA, responsible for collecting burn incidence data, developed a new form which was adopted by the commonwealth as the official form on January 1, 1976.
- sending two letters to the hospitals when the new reporting form was released. One, from the project's principal investigator, encouraged compliance. The other, from MDPH, ordered compliance.
- making spot check telephone calls to persons responsible for filling out the forms in hospitals and giving them feedback on the quality of the reports.
- receiving assurances from MDPH that inspectors would increase pressure on hospitals to comply with the regulation.

As noted, project staff decided to test the feasibility of collecting data directly from hospital medical records to gather accurate, reliable baseline data on burn incidence in the experimental and control sites. The feasibility study, which is now in progress, involves collecting burn information on all admissions and emergency room visits to three hospitals during 1975. Results will guide decisions on how to retrieve statistically valid baseline incidence data for the project.

Burn Victim Profile Data

In seeking respondents for the burn victim interviews, we were concerned about patient confidentiality and about safeguarding the physician-patient relationship. Before the project could contact a burn victim, permission for an interview was requested by the physician, the hospital, or MDPH. This procedure created some delays, and also affected the selection of respondents. Patients who granted permission to be interviewed probably did not feel threatened by the request; thus many victims and/or families of victims suffering severe stress or guilt because of the accident were not included in the sample. The lack of data on burn injuries due to child neglect or abuse, or to inflicted injury of any kind, should not be interpreted to mean that such accidents have not happened, but that families involved in such incidents were unavailable to project staff.

The profile data has been drawn primarily from the major burn facilities in Boston. Therefore, the data tend to include a higher proportion of severe burn injuries than would be expected of a random selection of burn patients in general hospitals of a large metropolitan area.

Educational Diagnosis

The purpose of the educational diagnosis, as noted, was to gather information concerning people's knowledge, attitudes, and behaviors with respect to burn and fire safety. One goal was to determine how much information people have. In addition, items were organized into three domains.

Types of Knowledge and Behavior:

- Underlying facts and concepts
- General awareness of the causes and consequences of burn injury
- Preventive behaviors to avoid fire or burn injury
- Behaviors to minimize harm once a fire or burn is in progress

Types of Burn:

- Scald
- Flame
- Contact
- Electrical
- Chemical
- Caustic
- Smoke

Types of Product:

- Electrical sources
- Fireplaces
- Flammable fabrics
- Flammable liquids
- House fires
- Matches/smoking materials
- Ovens/ranges
- Space heaters

In addition, information about the people's actual burn/fire safety practices was collected in the interviews.

The information was examined in terms of sample characteristics for each age group. The chart on the following page indicates the relationship between the population risk groups and elements of the diagnosis.

Evaluation Design

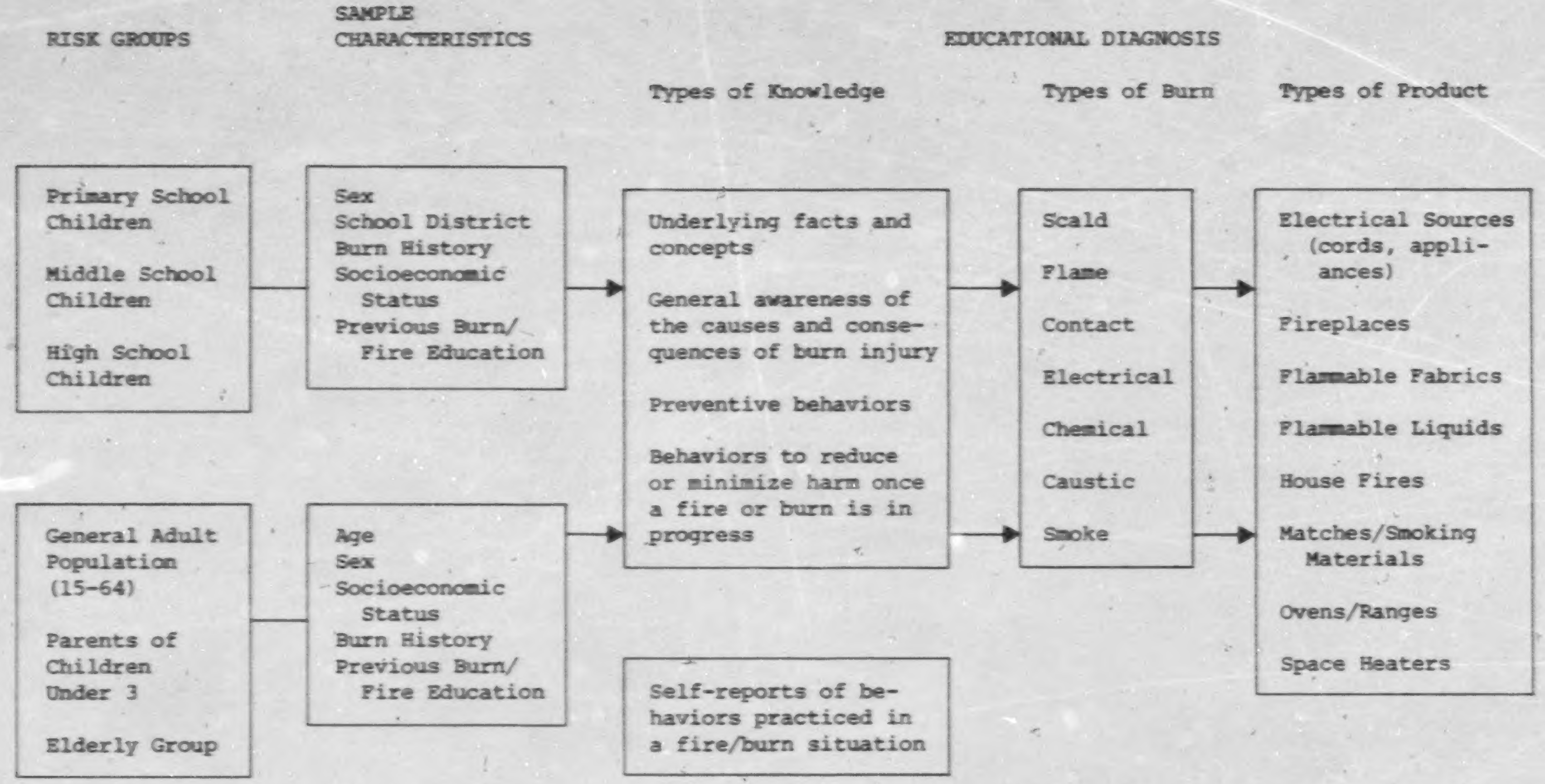
During Phase I, instruments were developed to gather baseline information and diagnose what people did *not* know about fire and burn prevention. Materials and strategies to increase knowledge and preventive behavior will be developed during Phase II. In Phase III, the educational campaign will be implemented, and in Phase IV, changes in knowledge, attitudes, and behavior will be evaluated.

The proposed testing design (Solomon Four-Group) to measure change is presented below.

Phase I Premeasures (before educational campaign)	Phase II Development of Materials and Strategies	Phase III Treatment (educational campaign)	Phase IV Postmeasures (after educational campaign)
Random Sample 1 (experimental site)		Random Sample 1 (experimental site)	Random Sample 1 (experimental site)
Random Sample 2 (control site)			Random Sample 2 (control site)
No Premeasures Random Sample 3 (experimental site)		Random Sample 3 (experimental site)	Random Sample 3 (experimental site)
No Premeasures Random Sample 4 (control site)			Random Sample 4 (control site)

Nature and Variety of Instruments Used

Several techniques, including criterion-referenced tests, telephone surveys, and home interviews were developed to provide baseline data and to reveal deficiencies and misconceptions in burn/fire prevention knowledge.



RISK GROUPS

SAMPLE CHARACTERISTICS

EDUCATIONAL DIAGNOSIS

Types of Knowledge

Types of Burn

Types of Product

Primary School Children

Middle School Children

High School Children

Sex
School District
Burn History
Socioeconomic Status
Previous Burn/Fire Education

General Adult Population (15-64)

Parents of Children Under 3

Elderly Group

Age
Sex
Socioeconomic Status
Burn History
Previous Burn/Fire Education

Underlying facts and concepts

General awareness of the causes and consequences of burn injury

Preventive behaviors

Behaviors to reduce or minimize harm once a fire or burn is in progress

Self-reports of behaviors practiced in a fire/burn situation

Scald
Flame
Contact
Electrical
Chemical
Caustic
Smoke

Electrical Sources (cords, appliances)
Fireplaces
Flammable Fabrics
Flammable Liquids
House Fires
Matches/Smoking Materials
Ovens/Ranges
Space Heaters

- Criterion-referenced tests sought to determine what information respondents had about burn/fire hazards and how they thought they would act in burn/fire situations.

- Telephone surveys sought to assess the overall level of awareness of the population at large. Findings were intended to inform development of mass media campaign during Phase II.

- Interviews were conducted with selected respondents to learn the reasons underlying respondents' test answers.

A copy of each instrument used in the diagnosis and items classification by domain can be found in Appendix I.

The chart on the following pages briefly describes the instruments, sample groups, sampling techniques, sample size, and special considerations.

Measurement Techniques

Criterion-Referenced Testing

Criterion-referenced testing was selected to establish a baseline of the general public's knowledge and understanding of concepts, general awareness, and behaviors related to burn/fire prevention. Since it was not feasible to use measures that always correspond to the ultimate criterion (what one does when confronted with a burn situation), the best alternative was to find an indirect or intermediate criterion related to (or predictive of) performance in the crisis situation.

Because criterion-referenced testing is a relatively new technique, it is useful to distinguish between it and norm-referenced testing. The essential difference between the two measurement devices relates to the interpretation of results. While scores on norm-referenced tests are used to compare one person's performance with the accomplishments of other people, CRT results can be analyzed to determine whether a given person (or group of people) accomplishes a task, regardless of the performance level attained by others. Thus, on a CRT, a person's success is dependent on his or her own accomplishments rather than the performance level achieved by others (the norm group).

The relevance of criterion-referencing to educational program evaluation relates directly to CRT score interpretation. Learning objectives inherent in the educational program are one set of standards (criteria) against which the program's success can be measured. The issue is not, "Did person A learn more than person B?" but rather, "Did persons A and B both learn what the program intended?" For this reason, criterion-referenced tests are often referred to as "objectives-referenced" tests. Each learning objective is translated into a set of questions or performance tasks that represent a sample of knowledge or behavior keyed to the objective. Thus, performance on that sample of items measures the extent to which the objective is attained. The match between items and objectives is critical.

For this project, three paper-and-pencil versions of the test were developed for use with different age groups. The telephone survey was an oral adaptation of the written test.

Interviews

To explore the reasoning behind respondents' answers on the criterion-referenced tests and to refine specifications for the diagnosis, interviews were conducted with smaller samples of individual adults and children. The criterion-referenced test itself contained many multiple-choice items that do not allow the respondent to explain the reasoning behind his or her answer. Interviewing provided an opportunity to explore the respondents' reasoning.

Only two features mentioned in the original proposal were eliminated as measurement techniques. The simulation game was not included, as it was felt to be an inefficient way to gather required information in the pretest. The Osgood Semantic Differential technique for assessing attitude was eliminated in favor of multiple-choice items. The format of the Semantic Differential, requiring polar opposite adjective pairs, was found to be too complicated to assess common attitudes toward burn/fire prevention.

Derivation of Priority Objectives and Messages for Each Risk Group

The first step in the measurement process was to determine what people should know to prevent burn injuries. Principal sources of information were literature, case history reviews, and experts in the field of fire/burn safety.

Literature Review

The sources that proved most helpful in the initial search included:

> *An Annotated Bibliography for the Non-Burn Specialist: Selected Literature Related to Childhood Burn Injuries.* Shriners Burns Institute, Boston Unit, April 1975 (see Appendix E).

	INSTRUMENTS	AGE GROUP	SAMPLE SIZE	
	Criterion-Referenced Tests (CRT)		Experimental Site	Control Site
CHILDREN	Picture version with 24 multiple-choice questions. Questions and answer-options read aloud by trained project staff member (average completion time = 25 min.).	Primary school: Grade 1 (ages 6-7)	213 children, distributed across 10 classes in 6 districts.	193 children, distributed across 10 classes in 5 districts.
	42 multiple-choice and 13 short-answer questions. Questions and answer-options read aloud by trained project staff member (average completion time = 40 min.).	Middle school: Grade 5 (ages 10-11)	212 children, distributed across 9 classes in 6 districts.	42 children, distributed across 10 classes in 5 districts.
ADULTS	58 multiple-choice and 13 short-answer questions. Completed independently by students in class (average completion time = 45 min.).	High school: Grades 8 & 11 (ages 13-19)	203 8th-grade and 202 11th-grade students, distributed across 21 classes in 6 districts.	50 8th-grade and 74 11th-grade students, distributed across 19 classes in 5 districts.
	Same core questions as high school students: 40 multiple-choice questions mailed home (average completion time = 40 min.).	15-24 25-44 45-64	29 adults: 9, ages 15-24; 16, ages 25-44; and 4, ages 45-64.	30 adults: 5, ages 15-24; 13, ages 25-44; and 12, ages 45-64.
	In addition to 40 core questions, 7 multiple-choice questions for critical risks to children under 3 (average completion time = 10 min.).	Parents of children under 3	30 parents	12 parents
	Core CRT questions presented orally by trained project staff at respondent's home (average completion time = 45 min.).	Elderly	33 elderly	6 elderly

SAMPLING TECHNIQUE	PURPOSE OF DATA	SPECIAL SAMPLE CONSIDERATIONS
Random sampling of schools by assigning random numbers to all schools and districts listed in *Mass. School Directory* 1974-1975. Individual classes were chosen by principal.	To provide baseline information and to diagnose deficiencies and misconceptions in burn/fire prevention information.	10 District Superintendents were contacted; the first 6 to agree became the sample. The city of Boston was purposely excluded due to irregularities caused by busing. Insufficient time for administration of tests in control site resulted in some classes not finishing; an entire class which did not complete the test was systematically eliminated before the data analysis occurred, hence smaller size (N = 42).
Volunteers (who agreed to follow-up) from random pool of telephone interviewees.	To explore extent of unsafe practices and to diagnose knowledge deficiencies and misconceptions.	In the experimental site, only 29 of 599 adults (15-64; without children under 3) agreed to participate in the follow-up, a response rate of 5%. In the control site, 30 of 401 agreed, a response rate of 7%.
Volunteers whose names (every 5th) were selected from files of health institutions in two selected communities in the Boston area. Project staff had liaison with community health leaders.		Only a few (N = 5) parents of children under 3 who had been initially contacted from the telephone survey agreed to participate in the follow-up. One of the communities from which additional respondents were eventually selected was biased in the direction of upper middle class.
50% selected by manager of housing project for elderly; 50% solicited by project staff interviewer in lobby of housing project for elderly.		None of the elderly group who had been contacted initially by the telephone survey agreed to participate in the follow-up. Due to sampling difficulties, data are not to be used as indicators of baseline information, but only for diagnostic purposes.

	INSTRUMENTS	AGE GROUP	SAMPLE SIZE	
	Telephone Survey		Experimental Site	Control Site
ADULTS	37 questions in a variety of formats, asked by trained and experienced telephone interviewers. (Average completion time = 10 min.).	15-24 25-44 45-64	520 adults: 93, ages 15-24; 256, ages 25-44; and 171, ages 45-64.	326 adults: 54, ages 15-24; 139, ages 25-44; and 183, ages 45-64.
		Parents of children under 3	81 parents	48 parents
		Elderly	76 elderly	71 elderly
			Total N = 596	Total N = 397
	Interviews			
CHILDREN	Designed to elicit the "whys" behind respondents' answers to the tests (average completion time = 30 min.).	Primary school: Grade 1 (ages 6-7)	18 children, distributed across 2 classes in 2 districts.	__________
		Middle school: Grade 5 (ages 10-11)	18 children, distributed across 3 classes in 3 districts.	__________
ADULTS		15-24	Same as CRT.	Same as CRT.
		24-44		
		45-64		
		Parents of children under 3	Same as CRT.	Same as CRT.
		Elderly	Same as CRT.	Same as CRT.

SAMPLING TECHNIQUE	PURPOSE OF DATA	SPECIAL SAMPLE CONSIDERATIONS
Names drawn randomly from telephone books of the Boston and Springfield SMSAs, using a standard skip pattern, based on the ratio of the number of completions necessary to the number of phone numbers available for the total population.	To provide baseline information and to diagnose deficiencies and misconceptions in burn/fire prevention information.	Although the best current vehicle for drawing numbers, the telephone book has two limitations: it does not list the entire population; and the majority of entries are men. The sample was therefore controlled in the following ways: male/female ratio paralleled the population (49%/51%); and center city/suburban ratio paralleled SMSA population.
Teachers were provided with specific instructions to ensure that the student sample represented a range of academic abilities.	To explore extent of unsafe practices and to learn reasoning behind deficiencies and misconceptions.	Same as CRT.
Same as CRT.	Same as Children Interviews.	Same as CRT.
Same as CRT.		
Same as CRT.		

Fire Education Research, prepared for National Fire Prevention and Control Administration by Whitewood Stamps, Inc., December 1975. This bibliography contains 272 entries catalogued by subject matter, author, and title. The Burn Prevention Project staff assisted Whitewood Stamps in the collection of this material.

CPSC Fact Sheets, information sheets on burn-related consumer products, were helpful for selecting appropriate goals and content.

Field Expert Involvement

On September 23, 1975, representatives from the fields of medicine, education, public health, media, fire services, research and evaluation, consumer safety, and people having personal experience with fire and burns, attended an all-day workshop. Participants were asked to list what they considered to be critical dangers for each high-risk group. Then they assembled in small groups to rank and discuss in detail the goals and concepts for each risk group. A summary of the workshop, entitled "Priorities for Educational Diagnosis," was sent to CPSC on October 26, 1975, along with a list of participants and their affiliations (see Appendix F).

Development of Instruments

Once the objectives defining what people should know about burn/fire prevention had been explored and refined, the process of developing items to match the objectives began. Without knowing the actual statistics relating to burn injuries across age groups (collection of incidence data was taking place concurrently), we attempted to write items for almost all the objectives covering all types of burns. Hazards to particular risk groups were highlighted, so that more items on a particular type of burn were created for some risk groups. For example, since flame burns resulting from house fires and matches were thought to be a serious problem for children 3 to 8 years old, questions for that age group focused on those risks.

The following basic considerations guided work.

- Although a variety of formats was used for the criterion-referenced test (multiple-choice, short-answer, and open-ended questions), the multiple-choice format was used predominantly to measure information and conceptual understanding because of its efficiency and ease of scoring.

- To avoid confounding knowledge with reading level, pictures were used whenever possible. For young children and for the elderly, questions were presented orally, and answer-options presented.

Content Validity

Since the match of items and objectives is essential in criterion-referenced testing, it was important to establish the content validity of the instruments. Consequently the same group of experts who had met to formulate objectives were asked to review the instruments and comment on the correspondence of objectives and items. The instruments were also reviewed by a national panel of experts (for participants, see Appendix G), the project's sponsor, the CPSC advisory council, and an experienced test specialist to catch factual errors and to try to locate and eliminate at least some of the inadequate items. From the reviewers came recommendations for adding and/or eliminating several items, and for revising the wording of some items. After the suggested changes were made, drafts of the revised instruments were prepared for trial testing with each age group.

Administrative Procedures

Staff members were trained specifically to administer the criterion-referenced tests and to interview the school-age and adult samples. An all-day workshop was conducted to orient test administrators and interviewers to the burn problem, and to train them in the use of the instruments and provide an opportunity to practice procedures and techniques. Interviewers worked from a structured interview schedule, and test administrators used a manual containing the read-aloud answer options in pilot testing the instruments to:

- refine administrative procedures;
- identify weak or defective items;
- determine how many items should be included in the final test;
- determine whether the time limits for the tests were appropriate.

A range of respondents was selected (nonrandomly) to represent the target audience (for details of the sample, see Appendix H).

All of the trial-test data were tabulated by hand in order to learn:

- how many respondents chose the correct answer;

- how many chose each distracter, omitted the item, or did not reach the item;

- how many chose "don't know";

- the frequency with which each age group chose each option.

Based on this feedback and the analysis of responses to individual items, items were revised, administration procedures finalized, and the final instruments were printed and administered.

How Data for the Educational Diagnosis Were Analyzed

Overall and Subscores

Test administrators and interviewers hand-delivered all data to the project. Once all data were collected, answers to all closed questions were transferred to standard computer sheets, keypunched onto cards and computer analyzed. Coding categories and manuals were developed for the analysis of short-answer and interview questions, after which they too were computer analyzed. All interviews underwent content analysis as well.

As to the extent of people's knowledge, all criterion-referenced tests were scored; every question was weighted equally and received one point. Subscores were computed for type of knowledge (e.g., concepts, awareness, etc.), information about type of burn (e.g., scald, flame), and product (e.g., flammable liquids, fabrics, etc.). Scores were derived by computing the average percent correct, that is, the number of items correct over the total number of items. (Items and the corresponding domains in which they are subscored can be found in Appendix I.)

Individual Items

For the analysis of individual questions and response patterns, basic frequencies were used. For the analysis of performance on individual items and the accomplishment of specified objectives, basic frequencies were used and a criterion was established for making decisions about how well questions were answered. All items and their corresponding objectives were placed in a category of high, medium, or low, high containing those items answered correctly by most respondents, low by least. Recommendations for the contents of the educational program were primarily based on the items falling in the low group. The criteria for assigning items for each age group were:

Age Group	High	Medium	Low
Primary School: Grade 1	Over 85% of respondents correctly answered item	Between 65-85% correctly answered item	Less than 65% correctly answered item
Middle School: Grade 5	Over 65%	45-65%	Less than 45%
High School: Grades 8 & 11	Over 65%	45-65%	Less than 45%
Adults: 15-64 Elderly Parents of Children Under 3	Over 65%	45-65%	Less than 45%

For all groups except primary school children, the criteria are the same. For that group, the criteria were made higher, because overall a higher percentage of students answered all items on the test correctly, and to be able to better distinguish deficiencies and misconceptions, different criteria were chosen. Since it is the goal of the project to improve understanding, it was decided that if a third of the primary school children did not accomplish an objective, it should fall in the low group, since a knowledge deficiency regarding burns could very easily be fatal to respondents in this age category.

Relationship Between Scores and Sample Characteristics

To examine the relationships between knowledge, attitude, safe practices and sample characteristics (e.g., sex, SES, income, etc.), differences in the means of overall scores and subscores were compared. In each case the following analyses were performed.

In general, the approach was to compare the needs of subsamples through simple, one-way analysis of variance, using either the T or F statistic. In some cases, overall scores were recoded into high, high average, low, low average (based on the following standard deviations from the mean:

low, 1/2 or less; low average, 0 to -1/2; high average, 0 to +1/2; high, +1/2 or greater) to examine the distribution of scores rather than only the mean. In this case chi-squares were used.

Future Analyses

The original purposes of the instruments developed for use in Phase I were to provide:

- educational baseline data of current knowledge, attitudes and behavior from which change would be measured in Phase IV;
- descriptive information to diagnose knowledge deficiencies, misconceptions, and identify typical unsafe burn/fire prevention behaviors.

In Phase I, both of these purposes were accomplished, but the extent to which these data can be used to measure change will depend on the risk groups, content, and geographic location selected for the educational program. Some modification of the instruments, possibly involving the elimination, addition or change of emphasis in objectives is anticipated. During this process some of the major instruments will again be revised.

At this time total test and subtest reliability as well as item analysis will be conducted. Since these operations were not conducted prior to these analyses, interpretation of tests of significance must be treated with caution. Revision of the existing instruments will be not only for the purpose of conducting some additional pretesting for this study, but also to provide tools which can be used across major cities to replicate the study.

Results of the data analyses and the findings of the educational diagnosis are organized in the report according to the following outline:

- Summary of findings
- Characteristics of the sample and media habits
- Nature and extent of knowledge (overall scores)
- Domains and related subscores (type of knowledge, type of burn, type of product)
- Analysis of individual items
- Relationship of knowledge to selected sample characteristics

Children 3 to 8 Years of Age

Summary:
Children 3 to 8 Years of Age

Burn injuries to children 3 to 8 years old comprise 9.8% of the burns recorded in the state data, while this same age group comprises 11% of the total Massachusetts population. The state incidence data indicate that boys are burned two-and-a-half times more frequently than girls. Scald accidents, most often happening in the kitchen, make up almost two-thirds of all burn injuries to children in this sample. Flame ranks second, followed by contact with hot surfaces, and electrical burns, as other types of burns in this sample. Of the flame burns, almost a third result from house fires, while the rest are single-ignition, single-victim injuries, most often caused by matches and stoves.

The profile data on burn victims in this age group residing within the Boston SMSA allow certain generalizations:

- Scald burns (as indicated in the state data) occur more frequently (63%) than flame burns (18%). However, the results of flame burns are in every way more severe, including length of hospital stay, extent of body burned, and involvement of face and hands.

- As with children under 3, the 3- to 8-year-olds are vulnerable to bathtub scald injuries to a greater extent than older age groups. Nevertheless, kitchen-type scalds are more predominant, often occurring when a child pulls over a container of hot liquid upon himself. Some happen when a child bumps into an adult who is carrying a container of hot liquid.

- Other than house fires, children's play, involving the lighting of matches and cigarette lighters, is the major cause of single-victim, single-ignition flame burns in this sample. "Play" here is characterized as a child's experimentation or exploration of a fire source without adult direction. Nonplay flame burn injuries involve a child using or being near a flame source under adult supervision. This may happen, for example, when a youngster is helping an adult burn leaves or light a barbecue fire.

- Over three-quarters of the flame burn injuries involve clothing ignition. The distribution between children's daywear and sleepwear is almost equal.

- Older boys in this age group begin to exhibit a pattern of burn accidents involving flammable liquids and explosive powder more typical of the preadolescent and adolescent males.

- In electrical burns, these children parallel the youngest age group in being injured by household electric current, most frequently by putting electrical appliance or extension cord joints in the mouth, thereby sustaining electrical burns to the lips and tongue.

- With regard to adult supervision of children sustaining burn injuries, there is a tendency for an adult to be present at a child's scald accident; however, the absence of adult supervision seems characteristic in flame and electrical burns.

- Most caretakers knew to apply cold water to scalds, but all children whose clothing caught fire screamed, panicked and ran. The only emergency treatment to flame burn victims given by caretakers was to immediately transport the child to the hospital.

The educational diagnosis revealed certain general deficiencies and misconceptions in young children's knowledge of fire and burns:

- Out of a possible forty points, the overall scores tend to cluster at the higher end of the range, with an average 72% correct on all questions.

- Although both scald and flame burns are a major cause of harm to children between 3 and 8, those children tested appear to be fairly knowledgeable about the general causes of such injuries and appropriate preventive behaviors. However, they do score low on knowledge related to flammable liquids and fabrics, common causes of injuries to them.

- Most importantly, young children do poorly in identifying appropriate behaviors to minimize harm once a fire or burn is in progress.

A closer look at the data reveals specific deficiencies by major types of burns occurring for this age group.

Scalds

A need for information arises concerning scalds, which are associated with food preparation and hot bath water.

- Knowledge related to scalds shows that students are moderately aware that containers of hot liquids and bath water are sources of burns, but they misunderstand the possible harm of scalds. They tend to believe hospitalization for as long as a month is only necessary as a result of burns from flames.

Flame

At first glance first graders seem to know a great deal about flame burns, but a closer look reveals glaring problems.

Flammable Fabrics

Young children tend to get burned severely by playing or being near flame. In almost all cases, their clothing is ignited.

- First graders are generally aware of their own vulnerability to harm from flames. Almost unanimously they perceive danger in touching flame sources directly (lighted cigarette, match, candle, gas burner, etc.). However, they do not recognize that a far more severe injury can result from contact with ignition sources; nor are they aware of common situations in which clothing ignition can occur, such as climbing or reaching over the stove, spilling a flammable liquid on it, or trying to put out fires themselves.
- Children incorrectly believe that long-sleeved clothing provides protection from a flame, and is safer than bare arms. They do not recognize the correct style of clothing to wear when helping an adult cook.
- Children do not know to drop and roll if their clothing is burning.

Flammable Liquids

- Children cannot distinguish between common flammable and nonflammable liquids, with the exception of gasoline.

Matches and Lighters

Almost a third of the flame burns for children 3 to 8 result from their curiosity with lighting matches.

- Almost all of the children interviewed report that they had *NOT* been taught by an adult how to light a match properly, but said they knew how just from watching others do it. Some had tried it.

House Fires

House fires account for a third of the flame burns for this age group.

- Children score low in recognizing what to do if caught in a smoke-filled room of their house. None had ever practiced the best way to exit from his or her home in case of a fire.

Electrical Burns

Although electrical burns make up only 7% of the injuries to this age group, they usually occur to the face and mouth, permanently disfiguring the child.

- Youngsters do realize that the live female end of a cord can burn, but their understanding of electrical conductivity or passage of current appears limited.

Knowledge deficiencies for children of this age group appear to be the same across school districts with different socioeconomic characteristics and appear to be unrelated to previous experience with a burn injury. Interestingly, caretakers or parents of children who had received scald burns report that they now take precautionary measures in those situations, but very few mention taking new precautions to prevent other types of burns, such as flame or electrical.

Burn Injuries Occurring to Children 3 to 8 Years of Age

State Burn Incidence Data

What do the data from the Massachusetts Reporting System indicate about burn incidence among children between 3 and 8 years of age?

Approximately 9.8% (60 cases out of 611) of the state's reported burn population was between 3 and 8 years of age, in comparison to their being 11% of the total Massachusetts population. Of the 45 cases for which sex was noted, 32 (71%) were male and 13 (29%) were female, in comparison to their distribution: 51% male, 49% female in the total state population. Of these burn patients, 63% were treated and released, 32% were hospitalized, three persons (5%) were dead on arrival.

The distribution of injuries by type of burn is presented in the following chart.

	Scald	Flame	Contact	Chemical	Radiation	Electric	Unknown
N	38	11	4	—	—	4	3
%	63%	18%	7%	—	—	7%	5%

Scald Burns = 63% (38 cases)

Of the 3- to 8-year-olds reported scalded in the state data, 1 case (2.6%) involved domestic hot water systems, 28 (73.7%) were scalded in food-related accidents, and 9 (23.7%) occurred under unspecified circumstances.

Flame Burns = 18% (11 cases)

Children in this age group sustained flame burns most often as a result of house fires (4 cases = 36.4%). Two cases (18.2%) involved the use of a stove, 3 cases (27.3%) involved playing with matches, 1 case (9.1%) involved the use of a flammable substance in an arson attempt, and 1 case (9.1%) involved a lit candle.

Clothing was ignited in 8 out of these 11 flame burn accidents. Shirts and pajamas were the items ignited most frequently (3 cases each). The other items ignited were shorts or pants and a robe. The causes of clothing ignition for these victims were house fires (2 cases), match play (2 cases), using stove (2 cases), 1 arson attempt, and 1 candle.

Contact Burns = 7% (4 cases)

One case (1.7%) resulted from contact with a radiator, 1 from an oven door, 1 from a toaster, and 1 from hot metal.

Electrical Burns = 7% (4 cases)

Three of these cases (75%) resulted from chewing on a household electrical cord; the other (25%) from inserting a bobby pin into an outlet.

Burn Victim Profile Data

What Are the Characteristics of Children (3 to 8) Burn Victims?

Reports of burn injuries were examined for 113 children between the ages of 3 and 8; in-depth interviews were conducted with the children and/or families for 22 members of this group. The table below describes the children in the sample in terms of sex, race, household type, and number of siblings. The victims in this sample were predominantly white (91%). Seventy-four percent were living in families having two parents, and 18% lived with a single parent. Most have one to three siblings. One-third were from families with five or more children, and only three victims were only children. The injuries occur almost evenly to children of people who rent or own their own home. More boys than girls of this age get burned.

DEMOGRAPHIC CHARACTERISTICS: CHILDREN 3-8 YEARS

	N	% Total	% Respondents
Sex			
Male	63	55.7	55.7
Female	50	44.2	44.2
Race			
White	100	88.4	90.9
Black	9	7.9	8.1
Other	1	1.0	1.0
No Answer	3	2.6	—
Household Type	75	66.4	73.5
Both Parents/Children	18	16.0	17.6
Single Parent/Children	9	7.9	8.8
Other	11	9.7	—
No Answer			
Number of Siblings			
One	3	2.7	3.0
Two	24	21.2	24.7
Three	22	19.5	22.7
Four	19	16.8	19.6
Five	12	10.6	12.4
Six	12	10.6	12.4
Seven or more	5	4.4	5.2
No Answer	16	14.2	—
Home			
Owned	40	35.3	43.0
Rented	53	46.9	57.0
No Answer	20	17.7	—

What Types of Burn Accident Happen to This Age Group?

The distribution of injuries in the profile data* is shown below.

	Scald	Flame	Contact	Chemical	Radiation	Electric
N	27	56	13	2	—	15
%	24%	50%	12%	2%	—	13%

---

*The distribution by type of burn in this sample differs from the burn-type distribution in the state-reported burn incidence data. This sample reflects the interests and mandate of the agencies (BISU and CPSC) which conducted the investigations. A major focus of both agencies was flammable clothing since federal legislators were considering the need for federal standards to regulate the flammability of clothing. Hence, the sample includes a disproportionate number of severe flame burns. However, the severity of these burn injuries (discussed below) provides justification for studying this kind of accident in depth.

What Is the Relative Severity of Burn Injuries in This Age Group?

BURN INJURY INVESTIGATION DATA:
MEDICAL FACTORS FOR CHILDREN 3-8 YEARS

		% Respondents			
	N	All Burns	Scald	Flame	Other
Medical Treatment	N= 113		27		
Treated and Released	52	46	56	32	63
Expired	5	4	—	9	—
Hospitalized	56	50	45	58	37
Length of Hospital Stay					
Not Hospitalized	52				
Hospitalized	N= 56		12	38	10
1-9 days	14	25	36	9	70
10-29 days	14	25	27	26	20
30-49 days	13	23	18	29	10
Over 50 days	15	27	18	37	—
Extent of Burns					
Total Body Surface Area Burned	N= 113		27	56	30
Less than 5%	43	38	30	25	70
5-19%	36	32	60	29	13
20-39%	11	10	—	20	—
More than 40%	23	41	11	27	17
Body Surface Area With Third Degree Burns:					
No Third Degree Burns	24				
With Third Degree Burns	N= 89		23	41	25
Less than 5%	72	81	96	61	100
5-19%	8	9	4	17	—
20-39%	3	3	—	7	—
More than 40%	6	7	—	15	—
Body Area Injured					
Was Face Involved?	N= 113		27	55	30
No	63	56	70	60	37
Yes	49	44	30	40	64
Not Ascertained	1				
Were Hands Involved?	N= 113		26	55	30
No	75	68	81	58	73
Yes	36	32	19	42	27
Not Ascertained	2				
Were Genitalia Involved?	N= 113		27	53	30
No	104	94	100	89	100
Yes	6	6	—	11	—
Not Ascertained .	3				

Of all the children within this age group who were burned, about 5% died, 49% were hospitalized, and 46% were treated and released. Forty-one percent received burns covering more than 40% of the body with about a third having less than 5% of their body surface area harmed. About half of the children were injured in the area of the face, a third on the hands, and in 6% of the cases the injuries were incurred in the area of the genitalia. Of the children who were hospitalized, the length of stay is almost evenly divided between under thirty days and over thirty days.

As has been previously reported in the state data, scalds occurred most frequently, at a rate of almost four times that of flame burns. Although most burns are scalds, flame burns tend to result in more severe consequences. More patients who had been scalded were treated and released (56%) than were those who incurred flame burns (32%). Similarly, slightly more children who experienced flame burns were hospitalized (58%) than those who were scalded (45%). Of those patients hospitalized for more than thirty days, more had flame burns (61%) than scalds (34%). Most notable is the fact that all the deaths resulted from flame burns. Twenty-seven percent of the flame burns injured a body surface area of more than 40% while only 11% of the scalds involved this amount of body surface. Flame burns more often involve injury to the face and hands and genitalia than do scalds.

When, Why, and How Do Injuries Occur?

Scalds

Children in the profile data sample suffered scald burns as follows:

- 17 by hot coffee, tea or water while preparing, serving, or drinking

- 4 by domestic hot water systems

- 4 by grease/oil

- 1 by soup/chowder, stew

- 1 other domestic scald

Of the scald victims, a few more are boys (59%) than are girls (41%). Not surprisingly, most of the scalds occurred in the winter season (45%), followed by fall (26%), spring (19%), and summer (10%). They occurred with equal frequency on weekdays and weekends. About one-third of the scalds happened between 9 A.M. and noon and about 20% occurred between noon and 3 P.M. About 15% each took place between

6 A.M. and 9 A.M., and another 15% occurred between 6 P.M. and 9 P.M. It is somewhat surprising that only 8% occurred during the most common hours for meal preparation (3 P.M. to 6 P.M.).

Most scalds took place in the victim's residence (85%): specifically, in the kitchen (74%) and in the bathroom (22%). Four percent of the injuries happened in the bedroom. Most scald victims were not suffering from a disability prior to the accident. Of those who were (8%), two were mentally retarded and one was bedridden. Scalds were most often the result of the victim's own activity, although the victim was an innocent bystander in some cases (26%). The in-depth interviews revealed that most scalds typically occur when a child pulls over a container of hot coffee, tea, water, soup, or grease and oil. Some scalds occurred when a child bumped into an adult serving or carrying a container of hot liquid. Others resulted from domestic hot water systems.

Following are brief sketches of scald accidents.

Hot Liquids for Drinking

A 6-year-old boy closed the cord of an electric coffeepot in a counter drawer, tipping the pot over on himself; his mother was present in the kitchen. (Hospitalized 5 days.)

A 5-year-old boy climbed up on an unsteady chest on which had been placed a cup of hot water and knocked the cup upon himself. (Hospitalized 23 days.)

A 5-year-old girl spilled a cup of hot chocolate on herself. (Not hospitalized.)

A 3-year-old girl hit a saucer placed near edge of counter, tipping cup over on self; mother present in kitchen. (Hospitalized 23 days.)

A 7-year-old girl bumped her grandmother who was holding coffeepot. (Hospitalized 9 days.)

A 7-year-old boy (retarded) pulled on cord of electric coffeepot in classroom of special school. (Hospitalized 34 days.)

Hot Liquids for Cooking

A 3-year-old boy tipped a can of hot bacon fat on himself. (Not hospitalized.)

A 4-year-old girl tipped over hot bacon fat when climbing near stove to get a drink of water. (Hospitalized 16 days.)

A 5-year-old boy picked up, then dropped, a can full of hot bacon fat; parents in kitchen. (Not hospitalized.)

An 8-year-old boy had hot oil spilled on him when a defective fondue pot tipped. His parents were present. (Hospitalized 30 days.)

Domestic Hot Water

A 3-year-old girl fell into a tub of hot bath water while she was momentarily left unattended by her father. (Hospitalized 54 days.)

In almost all of the scald cases, adults were present in the same room with the child. None of the victims did anything to treat themselves. In most of the accidents someone was present who responded appropriately to the emergency by removing the victim's clothing, applying cold water, and transporting the victim to the hospital.

Flame Burns

Children in the profile data sample suffered flame burns as follows:

- 22 playing with matches
- 10 playing near ignition sources
- 9 near ignition sources (nonplay)
- 5 other flame burns
- 4 lighting fires
- 3 using ignition sources
- 3 house fires

Almost twice as many boys as girls are injured by flame burns. Flame burns seem to have no specific regard for season, occurring with about the same frequency in each season. Most flame burns happened during the week rather than on the weekend.

About 18% of the accidents occurred between 6 A.M. and 9

A.M., while 20% occurred between 9 A.M. and noon, and between noon and 4 P.M. Another 20% were reported between 6 P.M. and 9 P.M. As with scalds, most accidents took place at the victim's residence (71%). Only 35% happened in the kitchen. Fifteen percent happened in the living room and another 15% occurred outdoors, near the house. Another 20% took place in other outdoor locations, such as parks, playgrounds, or the street. Of the 56 flame burns, 22 involved matches and smoking materials; 13 were from being near or using the stove; 3 were house fires; 20 involved flammable liquids, mostly gas and gunpowder, with some being cigarette lighter fluid and natural gas.

In most cases the burns resulted in clothing ignition, happening equally to sleepwear and daywear. Usually, the victim's first response to minimize harm was to scream and then run. Only three of the individuals correctly dropped and rolled. The most common reaction of the bystander was to try to remove the victim's clothing or to wrap a rug or blanket around him. Some slapped at the flames with their hands.

Following are brief sketches of flame burn accidents.

Matches/Smoking Materials

> An 8-year-old boy was playing with a wooden match in the woods; shirt ignited; was playing with one friend. (Hospitalized 41 days.)
>
> A 6-year-old boy was playing with cigarette lighter when pajama top ignited; was playing with two sisters. (Hospitalized 33 days.)
>
> A 4-year-old tried to light a cigarette with matches at 6:30 A.M.; pajamas ignited; was playing alone. (Hospitalized 38 days.)
>
> A 7-year-old girl was playing with a friend who lit a match and threw it at her; ignited sunsuit. (Hospitalized 56 days.)

Ovens and Ranges

> A 7-year-old boy turned on the gas burner to warm baby bottle and shirt was ignited; was alone in kitchen. (Hospitalized 60 days.)

House Fires

> A 5-year-old girl, burned in a house fire, was found unconscious in hallway by father; had been left alone in house. (Hospitalized 47 days.)
>
> A 4-year-old girl was burned in a house fire caused by leaking gas main; mother also injured in fire. (Hospitalized 58 days.)

Three of the accidents involving matches or cigarette lighters happened when the victim was playing with another child. In two instances, the victim was the player; in one, the victim was the innocent bystander. The fourth "playing with matches" accident occurred at 6:30 A.M., when the victim was the only family member awake. In no case was an adult present. The child who ignited his shirt at the stove was at home with an older sister who was not in the kitchen at the time.

Interviews revealed that some victims screamed and did nothing, but most ran. None shielded the face from the flames and a few slapped at the flames with their hands. In three instances, older siblings (ages 9 to 13) knew to extinguish flames: one by wrapping in a blanket, one by throwing water, and one by rolling the victim in dirt. In one instance, the father tried to beat out the flames with his hands, burning himself badly in the process. (He says he knew to drop and roll, but he met his son on the staircase and instinctively tried to extinguish flames right there.) In the other instance, an adult passerby extinguished the flames by wrapping the child in a coat.

In the interviews it was discovered that cold water as a first aid treatment was used in only one of these seven cases. It is interesting to note that the police, rather than firemen, transported the victim to the hospital in six of the seven cases, while a neighbor used a private car in the other case. Of concern was the report that the police responded in one case, but were unfamiliar with their equipment, and did not know how to use the resuscitator for the child found unconscious in the house fire. A neighbor who was a nurse showed them how to use it and accompanied the child to the hospital.

Other Types of Burns

The other burns involved mostly contact and electrical burns, with very few chemical burns. Almost all of these burn victims were treated and released, with only 18% requiring hospitalization. In all cases the length of hospital stay was less than thirty days. Most of the burns involved less than

5% of the total body surface area, though as many as 16% covered more than 40% of the body.

The profile data give an outline of how the remaining burns happen:

Electrical

- 14 from household appliance cords
- 1 from an indoor electrical outlet

Contact

- 3 by touching a room heater
- 1 by touching stove, cooking, or heating stove
- 2 by touching food in preparation
- 7 by touching electrical appliances (e.g., iron, electric hair dryer, etc.)

Although there were insufficient in-depth interviews from which to generalize about the other injuries, two of the electrical burns resulted from children putting an appliance cord or extension cord joint into their mouths, and two of the contact burns occurred under bizarre circumstances:

> A 3-year-old boy used his mouth to try to tug apart a clock/radio cord and an extension cord; playing with brother. (Hospitalized 7 days.)
>
> A 4-year-old girl put joint of appliance cord and extension cord in her mouth; had been left alone in apartment with two sisters, ages 8 and 7. (Hospitalized 4 days.)
>
> A 4-year-old girl hit by adolescent neighbor on motorcycle, burned by hot exhaust pipe on side of face. (Hospitalized 15 days.)
>
> A 6-year-old boy tried to "thaw" jaw which was "frozen" by dentist's novocaine by pressing hot kettle to chin. (Not hospitalized.)

Where Did the Families Learn How to React to the Emergency and What Precautions Have They Since Taken?

When asked how they knew what to do, families quoted several information sources. Two had previous experience with scald burns with other children, and had been instructed by a hospital on proper procedures. Two were RNs, though one cited her training and one faulted her training for not having included this information. Two cited "general experience with minor burns" as the reason for the cold water treatment. One mother knew to remove hot clothing, then called her 18-year-old brother who had had Boy Scout training; he knew to apply cold water.

Two cases were mistreated, in that baby oil and vaseline were used on the wounds. One of these families was Portuguese, and oil on burns was the traditional remedy. Another mother removed the hot clothing but did not cool the burned area with cold water; the child had just fallen into a tub of hot water.

When these families were asked what changes they had made to prevent other burn accidents, their precautions tended to be limited to the particular type of burn accident sustained. The family whose child fell into the tub replaced the hot water heater; the family whose dangling electric cord caught in the drawer bought a shorter cord; they rarely use the electric pot any more. The coffeepot in the classroom was removed. Bacon fat is now poured down the drain.

To prevent further injury to their children, three families whose children had been burned by flame mentioned the need to buy flame-retardant clothing for children; one family with the house fire installed a complete fire alarm system and now discuss exit drills from the home. No mention was made of efforts to prevent scalds or other types of burns.

Educational Diagnosis: Primary School—Grade One

Characteristics of the First-Grade Sample

For the purpose of the educational diagnosis, this section will focus solely on data from the experimental site. The primary school sample completing the criterion-referenced test consisted of 213 first-grade students between the ages of 6 and 7, from six school districts in the Boston SMSA. (See Appendix K.) To supplement the data and probe the reasons behind some of the responses to items on the criterion-referenced test, individual interviews were conducted with eighteen students from three of the districts in the random sample. The following table describes the experimental sample in terms of two demographic characteristics, sex and number in household:

Demographic Characteristics	Criterion-Referenced Test (N = 213)			Interviews (N = 18)	
	N	% Total	% Respondents	N	% Total
Sex:					
Male	107	50.2	51.0	9	50.0
Female	104	48.8	49.0	9	50.0
No answer	2	1.0	—	-	—
Number in household:					
1-4	85	39.9	43.6	8	44.4
5-6	93	43.7	47.7	7	38.9
7 or more	17	8.0	8.7	3	16.7
No answer	18	8.4	—	-	—

As the table indicates, girls and boys each represented about 50% of the basic sample. Over 40% of the respondents came from households of one to four persons. Nearly 50% reported five to six persons in their households, and about 10% came from homes with seven or more persons.

Nature and Extent of Knowledge

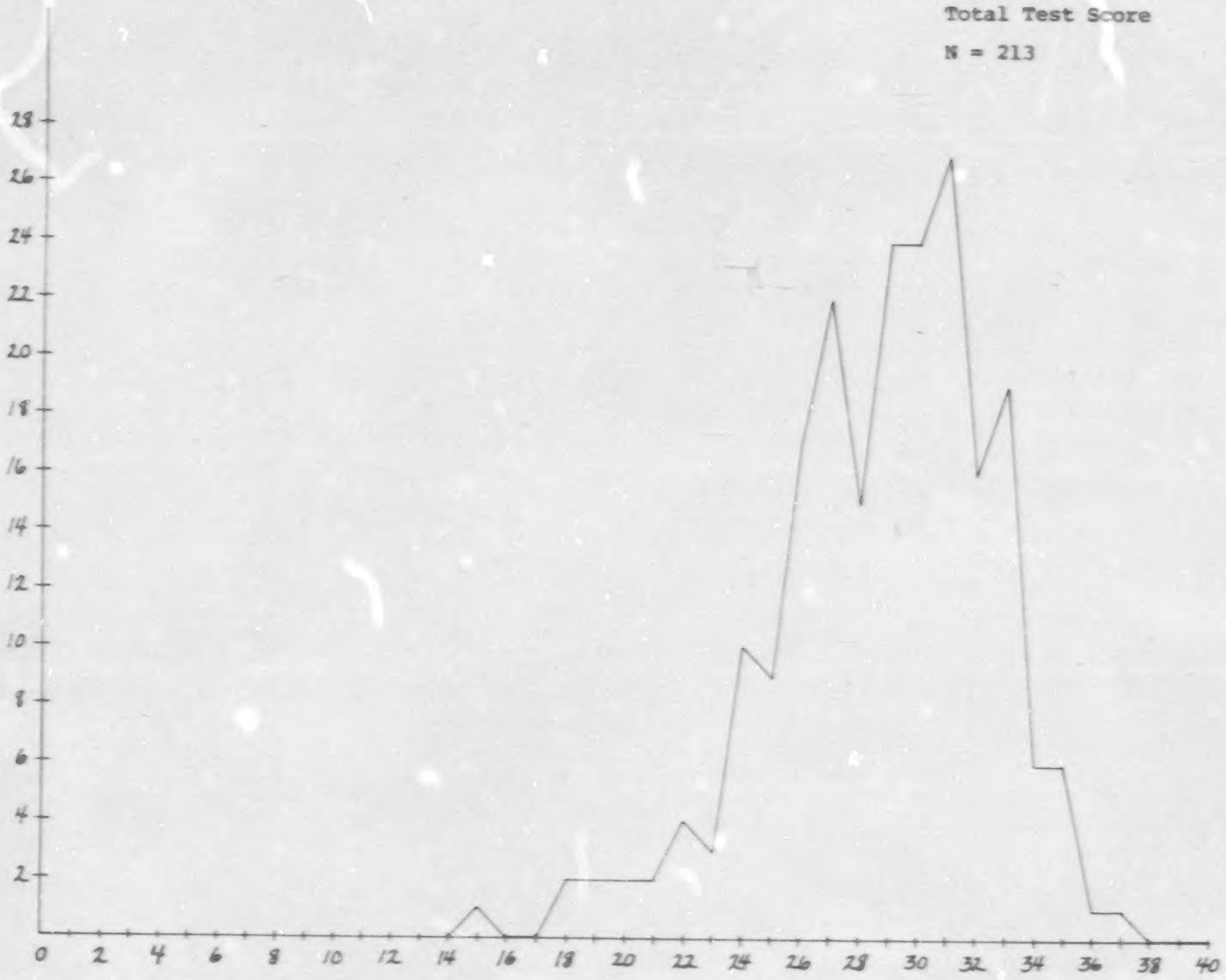
The basic purpose of educational diagnosis is to determine specific areas in which knowledge or knowledge deficiencies exist. This analysis is an important part of the baseline information which will be used to select appropriate messages and intervention strategies. The basic questions addressed in this section are: How well do first graders accomplish the objectives established for them? What specific information deficiencies and misconceptions do they hold? More specifically, this section summarizes "how much and what kinds" of information youngsters exhibit in terms of total score and of three domains--type of knowledge, type of burn, and product involved.

Total Scores on the Criterion-Referenced Test

The distribution of scores for the experimental group is illustrated on the following page. An examination of the distribution curve indicates that out of a possible 40 points on the test, scores ranged from 15 to 38 with a general tendency for scores to cluster at the higher end of the score distribution. The mean score is 28.8 with a standard deviation of 3.72.

Overall scores were recoded into four categories. As the table below indicates, students were divided fairly evenly among the four groupings, with most students (36%) falling in the high group.

Recoded Scores	No. of Items Correct	Standard Deviation from the Mean	% Students
Low	0-26	½ or less	24
Low Average	27-28	0 to -½	17
High Average	29-30	0 to +½	23
High	31-40	+½ or greater	36



Boston - Grade 1 - 1976

Total Test Score

N = 213

Domains and Related Subscores

Each item (where possible) was categorized in three different ways (domains) to reveal the specific nature of knowledge and knowledge deficiencies in the sample. Within each domain, a number of subscores could then be derived. The number of items which make up each subscore for first graders varies from 1 to 29, depending on the priority messages established for the age group and the number of reasonable questions that could be asked about any particular type of burn, product, or type of knowledge. The organizing domains, their related subscores, and the average percent correct for each subscore are shown in the table below.

As indicated in the table, the average percent correct on all items was 72%. In terms of type of knowledge, first graders in the experimental group ranked highest (81%) on items relating to general awareness of the causes and consequences of fires and burns. Preventive behavior ranked second highest (73%). Knowledge about behaviors that minimize harm once a burn or fire is in progress, and knowledge of underlying facts and concepts ranked lowest (63% and 58%, respectively).

DOMAINS AND RELATED SUBSCORES

	Total Possible Score	Average % Correct
ALL ITEMS	51	72
Type of Knowledge		
General Awareness	13	81
Preventive Behaviors	11	73
Behaviors to Minimize Harm	5	64
Facts and Concepts	7	58
Type of Burn		
Contact	3	78
Scald	3	77
Flame	15	76
Smoke	2	68
Electrical	3	50
Caustic	1	15
Type of Product		
Ovens/Ranges	3	91
Matches/ Smoking Materials	5	88
Fireplaces	1	81
House Fires	3	72
Space Heaters	1	62
Flammable Liquids	6	60
Flammable Fabrics	4	59
Electrical Sources	3	50

When scores were arranged by type of burn, knowledge related to four types ranked highest: contact (78%), scalds (77%), flame (76%), and smoke (68%). First graders were somewhat less knowledgeable about burns caused by electrical sources (50%). Although represented by only one item, the score on caustic burns was clearly the lowest among first graders, with an average percent correct of 15%.

A consideration of knowledge by type of product revealed that all students scored highest when ovens/ranges (91%) and matches and smoking materials (88%) were involved. First graders in the experimental group had somewhat less information about burns from fireplaces (81%) and house fires (72%). Space heaters (62%), flammable liquids (60%), flammable fabrics (59%), and electrical sources (50%) ranked lowest.

Individual Items

In addition to identifying the overall ranking within domains, we also looked at individual items in order to understand in more specific terms what students knew. Assuming that ideally *all* children should get *all* items correct on a criterion-referenced test, the clustering of scores toward the higher end of the distribution is not as positive a finding as it appears: it means that a substantial number of children still have information gaps.

In order to establish priorities among specific items, the items were divided into high, medium, and low categories according to the proportion of students who gave correct answers. The criteria to arrange scores were:

% Correct	Category
Over 85	High
65-85	Medium
Less than 65	Low

The items were evenly distributed between the high, medium, and low categories.

The items answered correctly by fewest students fell into three major clusters. The first involved fabric ignition. Specifically, the majority of students did not recognize behaviors that could result in fabric ignition (e.g., climbing on the stove) and did not recognize correct behavior for minimizing harm from fabric ignition, namely "drop and roll." The second cluster involved treatment of the burn (apply cold water), and the third, behaviors to minimize harm in the event of a house fire (close door to hallway and hang a towel from the window).

Additional items in the low category involved identification of a caustic substance that would cause burns if swallowed; proper electrical connections; a space heater as a cause of burns; and recognition of common flammable liquids.

The items concerning preventive behaviors that first graders answered most successfully involved having an adult present; that is, to prevent burns, children should cook *only* under adult supervision; and matches should be stored *only* by adults.

Those items answered most correctly overall involved an awareness of elements in the environment that may be direct causes of flame burn injuries: touching a lighted cigarette or a lighted candle; a gas stove with a burner on; a lighted firecracker, etc. These are all common, obvious sources of burn injuries. One problem arose in connection with flame as a source of injury, however. While first graders perceived danger in touching a lighted cigarette, candle, or lighter directly, they were not aware that the burner on the stove may set their clothing on fire if they climb on the stove; that a kerosene lamp should not be taken inside a tent; or that certain liquids will ignite near a flame source.

Discussion of individual items is organized around the type of knowledge domains; items are also classified by type of burn and product as indicated in the table.

Facts and Concepts

As indicated earlier, facts and concepts ranked lowest among the four kinds of knowledge exhibited by first graders. This group had trouble distinguishing common flammable liquids from nonflammable ones. Most students could fairly easily distinguish nonflammable items like orange juice and cola. But the only substance that most students identified as able "to burn easily or explode near a spark or flame" was gasoline. Few students checked nail polish, airplane glue, and hair spray as flammable; a moderate number of students were aware that turpentine is flammable too.

TYPE OF KNOWLEDGE—FACTS AND CONCEPTS

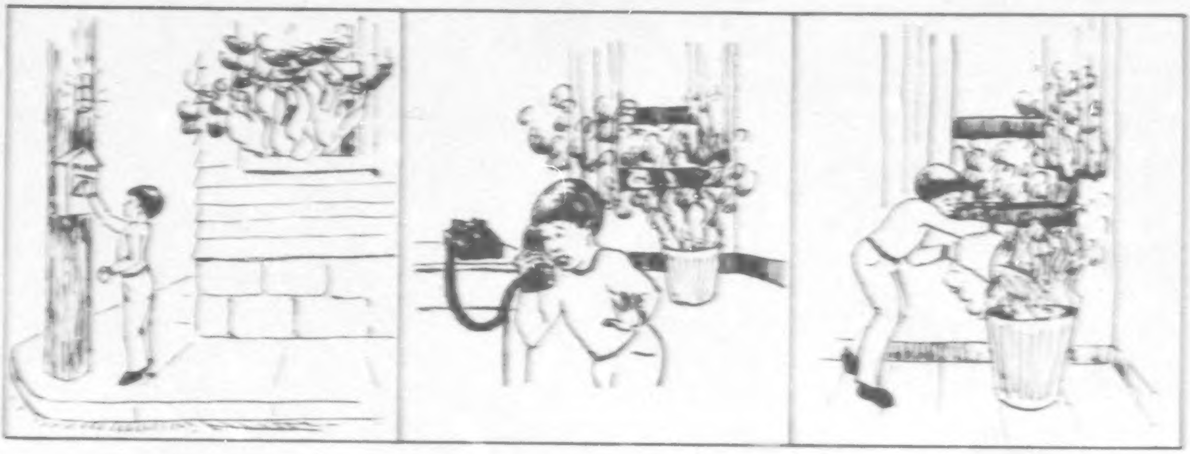
Question Number	Objectives	Type of Burn	Type of Product
HIGH	Distinguish between common flammable and non-flammable liquids:	Flame	
23(1)	-orange juice		
23(2)	-gasoline		Flammable liquid
23(4)	-cola		
MEDIUM 8	Identify materials which can combust spontaneously (newspaper and bundles of hay).	Flame	
	Distinguish between common flammable and non-flammable liquids:	Flame	
22(1)	-turpentine		Flammable liquid
22(2)	-cleanser		
20	Generalize that both contact with a hot iron and scalding by hot liquid are types of burns, though different in type.	Contact Scald	
LOW	Distinguish between common flammable and non-flammable liquids:	Flame	
22(3)	-nail polish		Flammable liquid
22(4)	-hair spray		Flammable liquid
23(3)	-model glue		Flammable liquid
21	Identify proper electrical connections.	Electrical	Electrical sources/ appliance cords

Few students recognized that an overloaded extension cord and a three-pronged plug used incorrectly can be a source of harm.

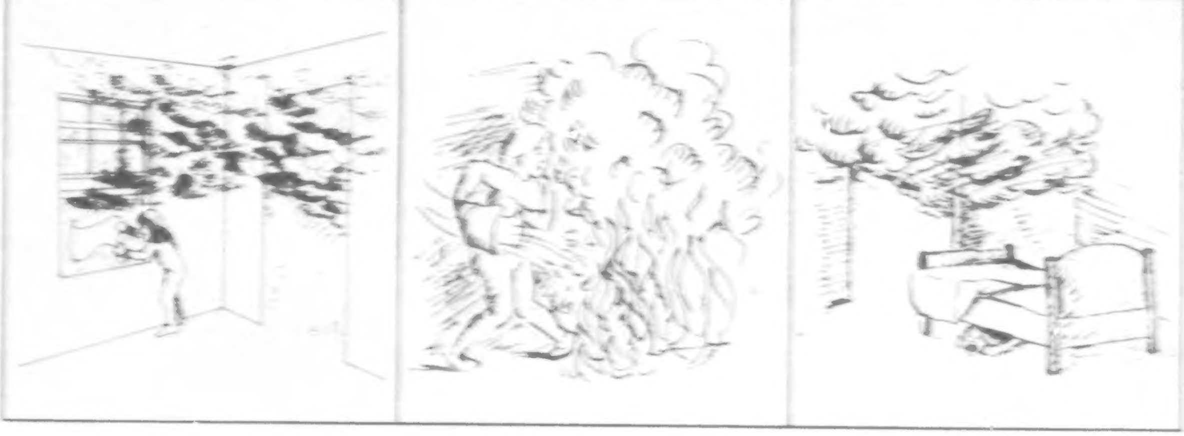
Seventy-seven percent of the students distinguished the garbage can from bundles of hay and newspapers as an object that would *not* burst into flame on its own. However, we do not know if students see the hay and papers as fuel for a fire, or if they indeed understand the properties of spontaneous combustion.

Behaviors to Minimize Harm

Behaviors to minimize harm ranked second lowest among the four types of knowledge. The discussion focused on behaviors in situations related primarily to house fires, flammable fabrics, and burn treatment. Students were presented with a choice of behaviors related to house fires in order to find out if they recognized that they should *not* try to put out fires themselves, but should seek help from an adult or from the fire department.



In one case, 26% of the students checked that they should try to put out the fire, while in the other only 6% did. Most students recognized that in a burning house, the best thing to do is "pull the fire alarm" outside the house rather than use the phone inside the house.



In another situation involving a house fire, very few children knew the best thing to do if they awoke in the night and found the room full of smoke. Only 52% said they would yell and wave a towel from the window. Another 34% said they would try to put out the fire, and 10% said they would hide under the bed.

TYPE OF KNOWLEDGE—BEHAVIORS TO MINIMIZE HARM

Question Number	Objectives	Type of Burn	Type of Product
HIGH —	—	—	—
MEDIUM 17	Recognize that to prevent harm once a fire or burn is in progress one should: Get out of a burning house immediately; not phone for help from within a burning building; not try to put out fire.	Flame	House Fire
15	Crawl when moving through smoke.	Smoke	House Fire
LOW 12	Recognize that to prevent harm once a fire or burn is in progress one should: Not try to put out fire; seek help from an adult or the fire department.	Flame	Matches/Smoking Materials
13	Drop and roll to extinguish flames.	Flame	Flammable Fabric
16	Apply cold water to a burn.		
24	If trapped in a house fire, hang towel from window; call for help from window.	Smoke	House Fire

The following responses to the question, "Which picture shows what you should do if there is a fire in your home?" illustrate what students were thinking:

> My mommy and daddy can jump out the window. My brother and I sleep in the same room...there is a window only about 6 feet high and I could jump it; there's a bush under it.
>
> If you were in the bedroom, right, watching TV or something and heard a big kaboom, right, I'd go out the window...I learned it by myself.
>
> I'd try to get out or I'd hide behind something... [because] I don't want to get burned.
>
> I'd go to the attic because there's a light up there and we store a lot of food...if the fire was

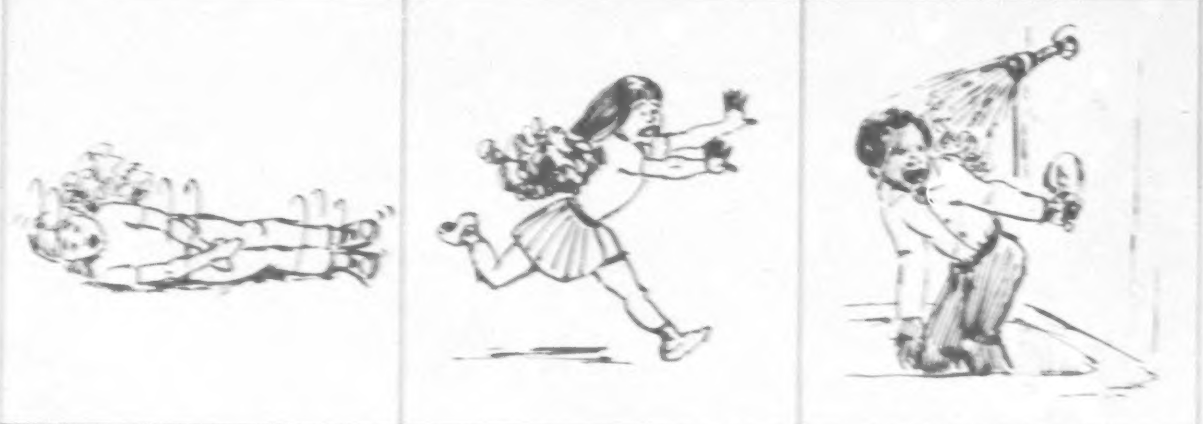
> there we'd go out, there's a door up on top of our roof...and we could go up on the roof and jump down.

On the criterion-referenced test, 82% said that the best way to move through smoke is to *crawl*, while only 14% said run. It seems this message had been taught previously to the majority of students in the sample. Some typical responses to the question, "Which picture shows the best way to move through smoke? Why?" are:

> Crawl because the smoke will be up above you...I saw it in a movie.
>
> Crawl 'cause the smoke won't go down that far.
>
> If you run it could get in your eyes and you couldn't see...it's safer to crawl under it where you could still see.
>
> Up here it's all smoke and down at the bottom it's all air. I saw that on a Dick Van Dyke commercial.
>
> Crawl so you won't suffocate.
>
> Crawl because if you get up there, you can't breathe.

On the criterion-referenced test, only half the students correctly chose "drop and roll" to extinguish burning clothing. Forty-one percent checked "get into the shower," with no thought that you might have to walk a distance to get to it. Examples of common interview responses follow.

> Interviewer:
>
> Which picture shows what you should do if your clothes catch on fire?



> It [drop and roll] puts the fire out...if you put yourself under water, the fire could spread down your clothes.
>
> If you run around the house and get in the shower, the fire might catch onto the floor.
>
> 'Cause it will suffocate the fire, if you roll in the dirt...if you put water on it, it will make it more fire, if you run and the wind gets on the fire it will make the fire get more.
>
> 'Cause if [you] put cold water on it...all the hot stuff will get warm...if you roll on the ground you might get hotter and hotter and hotter.... I would call my mother. She leaves the windows open sometimes. (What if your mother weren't around?) I'd run to my neighbor. (Is rolling back and forth a good idea?) I don't know.

The interviewer also asked first graders what they would do if they were standing near a friend whose clothes caught on fire, and began to run home. Only one student said she would "scream to tell her parents." One-third said they would tackle her, another third said get a bucket of water, and another third said run to phone the fire department. When asked why, students responded:

> Tackle her on the ground and roll her around 'cause it suffocates the fire.
>
> [Tackle her.] If you ran home it might get worse and if you called her parents they might not come quick enough.... (What would happen when she's on the ground?) It would go out.
>
> Run to tell the fire department because it's safer. If you roll on the grass, the grass will catch on fire.
>
> Stop and let me pour some cold water on her...then phone the fire department; take the clothes off and throw 'em away somewhere...I don't think tackle her on the ground would be good because you could get burnt.
>
> If you tackled her it would make more fire and you could get on fire.

Finally, when asked how they would attend to a burn immediately to minimize personal injury, 51% said they would put cold water on it, 41% ointment, and 5% butter. Some common ideas appeared in students' responses to the question, "If you burn your skin, which picture shows the best thing to put on the burn?"

> [Ointment] would make it feel better, it wouldn't sting as much.
>
> [Ointment] makes the burn stop burning. (What would happen with the others?) I don't know, I never tried that before.
>
> [Ointment] will make it get better faster than these two, butter and cold water.
>
> [Cold water will] put the fire out.
>
> [Cold water,] 'cause it can make the sore feel better.
>
> If [butter] goes in your skin it makes it feel better.

Preventive Behaviors

Questions related to preventive behaviors focused on electrical burns and potential situations of fabric ignition. Preventive behaviors ranked second highest for types of knowledge.

TYPE OF KNOWLEDGE—PREVENTIVE BEHAVIORS

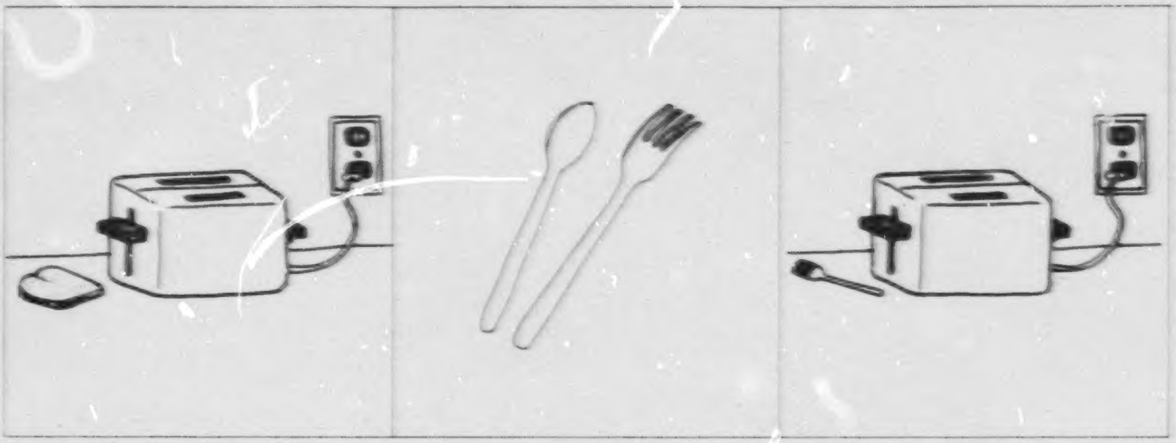
Question Number	Objectives	Type of Burn	Type of Product
HIGH	Recognize that to prevent burns one should:		
4	Not play near the stove.	Flame	Ovens/Ranges
11	Cook only under adult supervision.	Flame	Ovens/Ranges
14	Have matches stored only by adults.	Flame	Ovens/Ranges
MEDIUM	Recognize that to prevent burns one should:		
9	Not stand close to others engaged in activities with an open flame source.	Flame	
18	Never take an open flame inside a tent.	Flame	Flammable Fabric
19	Not sit in front of a fireplace without a screen; never dry clothing in front of a fireplace.	Flame	Fireplaces
LOW	Recognize that to prevent burns one should:		
7	Wear sleeveless or tight-fitting clothing when cooking with an adult.	Flame	Flammable Fabric
6	Not climb on or reach over the stove.	Flame	Flammable Fabric
10	Remove clothing on which a flammable liquid has spilled.	Flame	Flammable Liquid
5	Never use metal objects (e.g., fork) with a source of electricity.	Electrical	Electrical Sources

Half of the first graders did not know that they should never use metal objects with a source of electricity. Interviews revealed that only one child could supply the correct reason for not doing this. Most said the fork would burn if placed in the toaster.

Electrical Burns

Interviewer:

Which picture has two things which you should never use together? Why? What would happen?



> 'Cause if you put that in it might burn the fork and the toaster could blow up--you could get electrocuted when you're doing it.
>
> Fork could catch on fire.
>
> If you put in fork it would burn and then it could burn you if it popped out.
>
> The toaster could catch the fork on fire.
>
> It will burn the fork and make it look like wax and if it pops up the end could go in your eye and poke your eye out.
>
> Whole thing could blow up.

Fabric Ignition

Messages relating to fabric ignition appear pertinent for this age group. Only half the children knew they should "wear sleeveless or tight-fitting clothes when cooking." A third of the interviewees said that exposed skin could burn, hence arms should be covered.

> Interviewer:
>
> Which child is dressed properly for helping an adult to work around the stove? Why?
>
> Students:
>
> The long sleeves because they protect you. You

> could put them in the bathtub if they caught on fire. Short sleeves allow your arm to burn.
>
> Because sleeves wouldn't get burned, but you would.
>
> Because he has short sleeves and he could get burned and these kids have long sleeves and that's better.

Of those children who chose the correct option, few chose it for the right reason. Others chose it because the "short-sleeved" outfit looked like old clothes and "that's what should be worn to cook":

> Because she isn't dressed up good.
>
> Because she has old clothes on. If you wore these, these would be good and if you burned them up your mother would scream and yell at you. You'd get soot on them and everything.

On the criterion-referenced test, only half of the first graders chose the "best" option of removing clothing which has had a flammable liquid spilled on it. Thirty-two percent indicated it would be best to "wipe it with a sponge." Interviewed students said that the shirt should be removed because the turpentine itself could burn your skin; none responded that it was a flammable liquid presenting a danger because it could be ignited by a flame source.

When asked the safest way to get cookies that are stored in a cupboard above the stove, 32% checked the option of getting a chair to climb up and reach for them, even though an adult is present in one of the options for this item. Sixty-two percent chose the "adult is present" item, saying "you should ask your mother."

Only 70% recognized that one should never take a lamp with an open flame inside a tent; 24% indicated they could use a lighted kerosene lamp inside a tent.

A moderate number of students knew that they should neither sit nor stand close to open flames, particularly an unscreened fireplace, other children playing with matches, or an adult barbecuing.

Almost everyone correctly answered those questions for which the picture shows an adult present: "children should cook only under adult supervision," and "matches should be stored only by adults." Most children recognized in a general way that they should *not* play near the stove.

General Awareness

General awareness of the causes and consequences of burns ranked highest among the four types of knowledge. In an attempt to find out the perceptions of first graders to their own vulnerability in fire or burn situations, first graders were asked in interviews: "In what ways do you think most children get burned?" About half of the students said, "playing with matches." A few mentioned "fires in houses," "stoves," and "playing with plugs and wires."

> Fires that are in the house, like an oven starts on fire when you put too much water on it.
>
> If they take leaves and find matches that weren't in the rain and they light it up and they get burned and they put their foot in the fire and their sneaker burns and they lose a toe.
>
> By burglars. If all your family is sleeping, they might go down to the store and get a key to your house, open your door and then throw a match on your house and set it on fire.
>
> If there's a fire and you walk by it and trip on a rock and fall in it.
>
> Playing with matches.
>
> When they're a baby they climb up on the shelf and get matches and light them.

TYPE OF KNOWLEDGE—GENERAL AWARENESS

Question Number	Objectives	Type of Burn	Type of Product
HIGH	Distinguish items in the environment that may cause burn injuries from those that will not:		
1(2)	-lighted cigarette	Flame	Matches/Smoking Materials
1(3)	-lighted candle	Flame	
1(5)	-lighted cigarette lighter	Flame	Matches/Smoking Materials
1(6)	-lighted gas burner	Flame	Ovens/Ranges
3(7)	-unlighted book of matches	Flame	Matches/Smoking Materials
3(8)	-lighted barbecue	Flame	
3(3)	-plugged-in iron	Contact	
2(5)	-pan of hot liquid on the stove	Scald	
	Non-Burn Items		
2(4)	-pencil		
2(7)	-milk carton		
2(8)	-telephone		
3(1)	-work boots		
3(2)	-transistor radio		
MEDIUM	Distinguish items in the environment that may cause burn injuries from those that will not:		
1(8)	-lighted bare lightbulb	Contact	
1(4)	-tub of hot bath water	Scald	
3(6)	-cup of hot milk	Scald	
2(1)	-live female end of an electrical cord	Electrical	Electrical Sources/ Appliance Cords
2(6)	-turpentine	Caustic	
	Non-Burn Items		
2(2)	-fan		
3(4)	-knife and fork		
3(5)	-saw		
LOW	Distinguish common items in the environment that may cause burn injuries from those that will not:		
1(1)	-space heaters	Contact	Space Heaters
1(7)	-cleanser	Caustic	

On the criterion-referenced test, almost 90% of the students recognized objects in their environment that could be the cause of a flame burn: specifically, a lighted cigarette, candle, cigarette lighter, gas stove, firecracker, and barbecue. All of these objects tend to be common, rather obvious hazards which are direct sources of burns. Although the book of matches on the test was not lighted, most students still indicated that they could burn you.

In interviews, students perceived the danger of matches in a very general way. Half said you would burn your fingers by touching the match when lighting it and the other half said you could catch fire. None of those interviewed said that matches were dangerous because they could ignite clothing.

> Interviewer:
>
> In what way could the book of matches burn you?
>
> Students:
>
> If you light one. My friend lit one and gave it to me to hold and it burned down and burned my fingers.
>
> If you lighted them it would burn your fingers or if you lighted a cook-out with them by yourself and you put a lot of oil on before you put fire on first, then it would go up in flames and burn up the whole house.
>
> If you light one...once I held one and it went down to my finger.
>
> If you light it and put it on your hand.
>
> If you put them someplace like in the oven and you put a few sticks in, too, it would start to burn.
>
> Just by striking one.

The least well-recognized objects in the environment which could cause burns are the cleanser and the space heater. First graders did not seem to be aware that they can be burned by swallowing caustic substances. Although a moderate number of students on the criterion-referenced test checked turpentine as the cause of a burn, the interviews revealed that hardly any children knew it would burn if swallowed. The predominant way they thought it would be harmful was by touching skin.

About one-third of the students interviewed knew that a space heater could burn you without specifying how, while another third said, "by touching it." Another third knew it could shock or electrocute you, but the depth of that understanding appeared vague:

> People die kind of from pulling the plug real fast.

It could burn your fingers from touching it.

If you touch it and pull the plug at the same time.

Interestingly, two other items which were only moderately correct were sources of scalds: hot cup of milk (70.2%) and hot tub full of water (73%). Of the students interviewed, about two-thirds said that tub water can burn you badly. However, only a few agreed that tub water could burn badly enough to hospitalize a child for a month.

Interviewer:

Do you think bathtub water could burn you badly enough to make you stay in the hospital for a month?

Students:

No, because bathtub water is not as bad as a fire. Fire is hot, really burning hot, but there's no way this could.

Yes, because when hot water gets on you and you fall asleep or something, it gives you a shock.

Almost all children said that the hot cup of milk could burn. A third said it would occur "by touching the outside of the cup." Some said it would happen from "putting your fingers in it," while others said swallowing hot milk could cause a burn. Only one or two students thought a burn could result from pouring or spilling it on yourself.

Common Practices of First-Graders

To determine common practices of first-grade children, interview questions asked about their usual behaviors with respect to fire/burn prevention. Nearly all of the children said they had not been taught how to use matches properly, but said they knew how from watching others do it. Those who said they had been taught learned how from lighting fires in Scouts. However, this seems dubious since most scouting organizations don't admit children until they are in second or third grade.

Of those who knew how to light matches, typically they said you should: "Be careful not to burn your fingers, close the cover, and strike it on the other side."

When asked if they could get matches without bothering an adult, most said they could, but that they shouldn't. A few had lighted matches when grownups were not around:

> They're up in my cabinet.
>
> ...a jar where she keeps all the matches, I could jump on the counter and get them.
>
> From a closet, just get a chair, like I always do to get my glass.
>
> You have to bother someone because if you didn't ask...you could light it and the fire comes up and you've never seen it before and you could drop it on the floor and the whole house goes on fire. (She had had a similar close call, but did not drop the match.)

Regarding other common practices, we learned that most of the first graders do not cook at all. In the event of a fire in their home, children typically said they would go out of the doors or windows. One child said he would go to the attic. Only one child had actually practiced getting out. Of the children having fireplaces none said their parents would let them put wood or paper in the fireplace when it was burning.

A few children had tried to put out fires by themselves by stamping on them; others put out campfires with dirt and water.

Most children had not stood near people who were working or playing with fire. Two who did had been near children who were playing with matches. One friend got his fingers burned; the other friend's pants caught on fire, but he took them off and was not hurt.

Is Knowledge Related to Selected Sample Characteristics?

Overall burn/fire prevention knowledge for first graders was analyzed by sex and school district using mean scores. In general, differences were small. Relevant data follow.

Knowledge by School District

An examination of the mean overall scores for individual school districts in the experimental site indicates no differences across school districts: i.e., children from different school districts tended to be the same in their overall extent of knowledge about burns. The following table presents data relevant to this analysis.

Overall Scores by School District

School District	N	Mean Score*	Standard Deviation
1	41	29.10	3.79
2	28	27.32	2.70
3	39	29.80	3.10
4	38	28.79	4.19
5	44	28.55	3.89
6	23	28.61	4.19

*An ANOVA test resulted in a failure to reject the H^{O} at level $\alpha = .05$.

Knowledge by Sex

There is a statistically significant difference between boys and girls in their overall knowledge about burns, but in reality their mean scores are only a point apart.

Overall Scores by Sex

Sex	N	Mean*	Standard Deviation
Boys	107	29.30	3.81
Girls	104	28.30	3.43

*A t test resulted in rejection H^{O} at level of $\alpha = .05$.

In comparing the recoded scores, there was no statistically significant difference. However, while the proportion of boys and girls who scored in the low and low-average ranges was similar, a much higher percentage (43%) of boys scored at the high level than girls (28%).

Recoded Scores by Sex*

Sex	N	Low (0-26)	Low Average (27-28)	High Average (29-30)	High (31-40)
Boys	107	24%	16%	17%	43%
Girls	104	24%	19%	29%	28%
Total		24%	18%	23%	36%

*A chi-square test resulted in failure to reject H^{O} at level of $\alpha = .05$.

For sex an examination of subscores revealed differences that might be helpful in the development of materials and strategies. Boys and girls scored differently in all domains. Specifically girls scored significantly lower on items relating to general awareness of causes and consequences within type of knowledge: on contact and electrical burn items within type of burn; and on space heater and electrical source items within type of product.

KNOWLEDGE BY SEX
(expressed in average percent correct)

	Male	Female
ALL ITEMS	73	71
Type of Knowledge		
Facts and Concepts	59	56
General Awareness*	83	80
Preventive Behaviors	74	73
Behaviors to Minimize Harm	66	62
Type of Burn		
Flame	77	76
Contact*	84	73
Electrical*	53	47
Chemical	14	14
Scald	78	77
Smoke	69	67
Type of Product		
Flammable Fabrics	61	56
Flammable Liquids	60	60
Space Heaters*	67	56
House Fires	74	72
Matches/Smoking Materials	89	88
Ovens/Ranges	91	92
Electrical Sources*	53	47
Fireplaces	79	81

*A t test on raw scores resulted in rejection of the H^{o} at level $\alpha = .05$.

Children 9 to 12 Years of Age

Summary:
Children 9 to 12 Years of Age

The 9 to 12 age group comprises 3.6% of the state burn incidence data, while comprising 7.8% of the Massachusetts population. These figures imply that this group is less at risk from burning than adolescents or toddlers. Half of the burn victims in this sample sustained scald injuries, the majority of these occurring in the kitchen. Flame burns account for just under one-third of these injuries. Two contact burns and one electrical burn complete the sample.

The profile data on burn injuries to children between 9 and 12 years of age, residing in the Boston SMSA, allow certain generalizations:

- Severity of injury in this sample seems to be similar in both flame and scald burns. Face and hand involvement is more common in the flame burns, and the only fatalities were due to flame burns.
- Risk-taking behavior by small groups of peers appears to be an important factor in flame burns for this age group. Flame burn accidents characteristically happen while unsupervised groups of young boys are using or playing with flammable liquids or powders (especially gasoline and gunpowder). Girl bystanders are also often injured.
- Clothing, usually daywear, is ignited in almost two-thirds of these flame burn accidents.
- Scald burns happen more often in supervised situations and tend to be more "accidental" in nature than flame burns. The scalds usually happen during food preparation, serving or eating, and tend to be caused by spills due to inattention, quick unexpected movements, or inexperience.

- Other common burn accidents for this age group result from children trying to model the actions of adults in a work situation but having inadequate knowledge or experience.

- Although a small percentage of these children respond appropriately in an emergency situation, the majority panic and rely on bystanders to extinguish flames. Some bystanders tried to beat out flames with their hands, sustaining serious injury themselves.

The educational diagnosis revealed that on the average, this group gets about one out of every two items correct: the average percent correct for all items was 47%. However, there is considerable variation when looking at the nature of the information they possess. And more importantly, they have a number of critical knowledge deficiencies in high incidence areas.

The diagnosis allows certain generalizations:

- Preadolescents know least about scalds, even though scalds account for most burns among them.

- Knowledge related to flammable fabrics (involved in over two-thirds of the flame burn accidents) is the lowest score when looking at type of product involved. Similarly, ovens and ranges are frequently involved in burn accidents for this group, and scores related to them also fall at the low end in the product domain.

- Although preadolescents know "more" about flammable liquids and "most" about flame burns, both common elements of burn victim patterns, they hold a number of misconceptions that could result in serious burn injuries.

- Preadolescents report that they engage in many unsupervised "adult" behaviors such as soldering, cooking, and mowing the lawn. However, the knowledge of the proper precautions to be taken when engaged in these activities is quite low.

- In general, students know more about behaviors to minimize harm; do less well on general awareness of causes and consequences, and appropriate preventive behaviors; and do least well on knowledge of underlying facts and concepts.

- Over 95% of the preadolescents reported that they have received burn/fire safety information mostly from parents and fire departments.

- Preadolescents are great consumers of media, especially television; evening is the most popular viewing time, every day of the week.

Scalds

Students are unable to identify:

- Potential causes of scalds to self and others in a kitchen scene, including the correct placement of cooking pots on a burner.
- The proper procedures to use when a scald has occurred (even though students do best overall in identifying behaviors to minimize harm).

Flame

Flame burns are also common to preadolescents. Students are less aware of their vulnerability to burns by flame and are not familiar with the basic principles of combustion, such as what is needed for a fire to burn and which materials combust spontaneously.

Flammable Liquids

Students also do poorly on identification of flammable liquids and flammable fabrics, both of which figure predominantly in the patterns of burns to this age group. More specifically, they cannot:

- Identify common flammable liquids, or recognize their properties (for instance, they can burst into flame if kept in hot, closed space, are touched by a hot object, or are left in hot sun).

Interviews with preadolescents also reveal instances of making bombs from chemistry sets, mixing unknown chemicals, and firecracker wars. Children seem to realize the danger, but that is part of the excitement.

Flammable Fabrics

Since clothing ignition often takes place, it is important to note that students do poorly in their ability to:

- Recognize increased burn severity when flammable fabrics are involved and define what flame resistant means, as applied to fabrics.
- Identify appropriate preventive actions to avoid fabric

ignition—e.g., not to take an open flame inside a tent; not to use loose towels, or loose-fitting sleeves when working in kitchen; to wear heavily woven fabrics (such as denim) or wool when working near an open flame.

- Recognize that clothing on which flammable liquid has spilled should be removed immediately.

Matches and Lighters

Although "childish" match play is not as evident in the pattern of burns for preadolescents, matches are often used by these children in conjunction with flammable substances. In the diagnosis we find low scores in students' ability to recognize:

- The particular risks of matches and lighters as a cause of burns for the 3-to-9 age group.

- That cigarette lighters are dangerous because of the adjustability of the flame.

- That matches should be kept locked up and away from small children and, when used, extinguished with cold water before being thrown away.

The educational diagnosis revealed that overall knowledge does not appear to be related significantly to school district, burn history, or type of burn received. However, knowledge is related to sex. Boys score slightly better overall than do girls in this age group. This advantage is statistically significant for facts and concepts in the type of knowledge category; electrical burns within the type of burn category; and electrical sources and flammable liquids within the type of product category (despite the fact that boys are much more often involved in burn accidents involving flammable liquids).

Burn Injuries Occurring to Children 9 to 12 Years of Age

State Burn Incidence Data

What do the data from the Massachusetts Reporting System indicate about burn incidence among children between 9 and 12 years of age?

Approximately 3.6% (22 cases out of 611) of the state's reported burn population were between 9 and 12 years of age, in comparison to their being 7.8% of the total Massachusetts population. Of the 12 cases for which sex was noted, 8 (67%) were male and 4 (33%) were female in comparison to their distribution in the total state population: 51% male, 49% female. Of these burn patients, 68% were treated and released; 32% were hospitalized.

The distribution of injuries by type of burn is presented in the following chart.

	Scald	Flame	Contact	Chemical	Radiation	Electric	Unknown
N	11	7	2	—	—	1	1
%	50%	32%	9%	—	—	5%	5%

Scald Burns = 50% (11 cases)

Eleven preadolescents were scalded. Seven (63.6%) were injured in kitchen/cooking/serving accidents, and four (36.4%) under unspecified circumstances. No injuries were caused by domestic hot water systems.

Flame Burns = 32.8% (7 cases)

Seven children sustained flame burns as follows: two cases (28.6%) were the result of house fires, in two other cases (28.6%) the victim was lighting (nonplay) a fire or stove. Two of the flame burns (28.6%) resulted from the use of flammable substances. One involved the use of a flammable substance on an outdoor charcoal grill; the other involved experimenting with a flammable liquid and matches. There was only one instance of clothing ignition: the victim who used a flammable substance on the charcoal grill ignited his/her shirt. One case (14.3%) occurred under unspecified circumstances.

Other Burns = 14% (3 cases)

One case (4.5%) household current burn and two (9.1%) contact burns constituted the remaining state-reported cases for this age group.

Burn Victim Profile Data

What Are the Characteristics of Preadolescent Burn Victims?

There are 55 children in the 9-to-12 age group residing in the Boston SMSA whose project interviews or in-depth investigations are included in this profile study. The following table describes them in terms of sex, race, household type, and number of siblings.

DEMOGRAPHIC CHARACTERISTICS: CHILDREN 9-12 YEARS

	N	% Total	% Respondents
Sex:			
Male	38	69.1	69.1
Female	17	30.9	30.9
Race:			
White	49	89.1	90.7
Black	4	7.3	7.4
Other	1	1.8	1.9
No Answer	1	1.8	—
Household Type:			
Both Parents/Children	42	76.4	84.0
Single Parent/Children	7	12.7	14.0
Other	1	1.8	2.0
No Answer	5	9.1	—
Number of Siblings:			
One	2	3.6	4.3
Two	7	12.7	14.9
Three	11	20.0	23.4
Four	10	18.2	21.3
Five	9	16.4	19.1
Six	4	7.3	8.5
Seven or more	4	7.3	8.5
No Answer	8	14.5	—

In this sample, there are more than twice as many boys (69%) as girls (31%). Most children (91%) are white, from households where both parents and children reside (84%); 14% come from single-parent households. Most of the burn victims come from larger families; over half (57%) of the burn victims have four to seven or more siblings. Another 42% of the victims have between one and three siblings, and only 4% live in single-child households.

What Types of Burn Accident Happen to This Age Group?

The distribution of injuries in the profile data* is shown below.

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*The distribution by type of burn in this sample differs from the burn-type distribution in the state-reported burn incidence data. This sample reflects the interests and mandate of the agencies (BISU and CPSC) which conducted the

	Scald	Flame	Contact	Chemical	Radiation	Electric
N	10	42	1	1	—	1
%	18%	76%	2%	2%	—	2%

What Is the Relative Severity of Burn Injuries in This Age Group?

The burn severity for major types of burns are presented in the following table.

---

investigations. A major focus of both agencies was flammable clothing since federal legislators were considering the need for federal standards to regulate the flammability of clothing. Hence, the sample includes a disproportionate number of severe flame burns. However, the severity of these burn injuries (discussed below) provides justification for studying this kind of accident in depth.

BURN INJURY INVESTIGATION DATA:
MEDICAL FACTORS FOR CHILDREN 9-12 YEARS

			% Respondents			
		N	All Burns	Scald	Flame	Other
Medical Treatment	N=	55		10	42	3
Treated and Released		26	47	50	48	33
Expired		2	4	—	5	—
Hospitalized		27	49	50	47	66
Length of Hospital Stay						
Not Hospitalized		26				
Hospitalized*	N=	29		5	22	2
1-9 days		7	24	40	23	50
10-29 days		8	28	20	23	50
30-49 days		6	21	40	18	—
Over 50 days		8	24	—	36	—
Extent of Burns						
Total Body Surface Area Burned	N=	55		10	42	3
Less than 5%		22	40	40	38	67
5-19%		14	26	10	31	—
20-39%		4	13	10	14	—
More than 40%		12	22	40	17	33
Body Surface Area With Third Degree Burns:						
No Third Degree Burns		12				
With Third Degree Burns	N=	43		4	37	2
Less than 5%		35	81	100	78	100
5-19%		4	9	—	11	—
20-39%		2	5	—	5	—
More than 40%		2	5	—	5	—
Body Area Injured						
Was Face Involved?	N=	55		10	41	3
No		34	63	70	59	100
Yes		20	37	30	41	—
Not Ascertained		1				
Were Hands Involved?	N=	55		9	41	3
No		29	55	78	54	—
Yes		24	45	22	46	100
Not Ascertained		2				
Were Genitalia Involved?	N=	55		10	41	3
No		50	93	90	93	100
Yes		4	7	10	7	—
Not Ascertained		1				

* Includes the 2 persons who expired.

Overall, about half (53%) were hospitalized and half (47%) were treated and released. Four percent expired as a result of burn injuries. The length of hospital stay was about evenly divided among the four groups: 24% from 1 to 9 days; 28% from 10 to 29 days; 21% for 30 to 49 days; and 24% for over 50 days. About 40% of the victims received burns over less than 5% BSA; about 25% suffered burns over 5 to 20% BSA. Twenty-two percent suffered burns over 40% BSA, and 13% experienced burns over 20 to 40% of their body. In terms of body area, faces were involved in about a third of the cases (36%), while hands were involved in slightly more than 40% of the cases; less than 10% involved genitalia.

Looking more closely at the relationship between type of burn and severity, we find that the percentage of those treated and released and the percentage of those hospitalized is the same for scald and flame burns. One critical exception is that all of those who died were flame burn victims. In terms of length of hospital stay, we find that a somewhat higher percentage of those with flame burns required more than thirty days hospitalization than did those with scald burns (54% compared with 40%); conversely, scald burns seem to result in fewer days of hospitalization than do flame burns. Of all those whose hospitalization extended from one to nine days, 40% had scald burns and only 23% had flame burns.

More of the flame burns tend to involve the face (41%) and hands (46%) than do scald burns (30% and 22% respectively). Genitalia are involved in about the same percentage of scald and flame burns (10%, 7%).

When, Why and How Do Injuries Occur?

Scald Burns

Ten youngsters in this sample sustained scald burns:

- 6 by hot coffee, tea, or water while preparing, serving or drinking
- 1 by hot water from a faucet
- 3 by grease/cooking oil

These accidents occurred throughout the year, with a slight tendency for more scalds to occur in the spring and fall (30% each) than in the winter or summer (20% each). They occurred as frequently on weekends (50%) as weekdays, even though there are only two days in the weekend and five days during the week. Forty percent of these scalds occurred between 6 P.M. and 9 P.M.

Nearly all scalds occurred in the victim's residence, with almost 75% occurring in the kitchen. No victims had any noted physical or mental disabilities. The majority were injured as a result of their own activity (60%), with the remaining 40% injured as a result of another's activity (usually by being a bystander on whom someone else spilled a hot liquid).

From interviews with four of the eleven scald-injury victims, project staff learned that:

> A 9-year-old male splashed hot water on himself while draining water from pot used to boil himself an egg. (Not hospitalized.)
>
> A 9-year-old female was scalded when she bumped into her mother who was carrying a pot of hot water. (Not hospitalized.)
>
> A 10-year-old male at a beach picnic blew on a barbecue fire, got sparks in his eyes, and was momentarily blinded. He backed into his mother, who was carrying hot water, which spilled on him. (Hospitalized 8 days.)
>
> An 11-year-old male drenched himself with hot coffee from a large coffee urn which tipped when the table where it was placed was bumped by someone at a party. (Hospitalized 36 days.)

These interviews revealed that these scald burns happened in nonplay supervised situations, often in the presence of parents. Two occurred at parties, attended by large groups of people, including many adults. At the beach party, the mother had warned the children to be careful. The pattern in this accident--an active child bumps an adult carrying hot water--was repeated in the kitchen scald. The scald from a tipped coffee urn resulted from another common cause of burns: placing a potential hazard on an unsteady, inappropriate base. In this case, a 32-cup coffee urn was placed on a shaky TV table, which, when bumped by someone next to it, toppled and spilled.

Flame Burns

Children in this sample who sustained flame burns were engaged in the following activities:

- 17 while using a flammable substance
- 2 while lighting a fire

- 4 while actively using an ignition source
- 6 while being near, but not using, an ignition source
- 7 while playing near an ignition source
- 3 during match play
- 2 in a house fire
- 1 in another situation

These flame burns occurred most often in the spring (40%), and least often in the fall (14%), with slightly more incidence on weekdays (56%) than weekends (43%). There is an even distribution of these injuries throughout the day--a somewhat surprising finding, since all the children attended school and the majority of these injuries did not happen during summer vacation.

About two-thirds (64%) of these accidents happened in or around the victim's residence. An additional 12% happened at a friend's or neighbor's home. Outdoor locations were the scene of over half of these accidents. The yard accounted for 28%, and other outdoor places (woods, etc.) were the location for an additional 23%. The kitchen (25%) is the room in which most indoor flame burns occurred.

Almost three-quarters (71%) were injured as a result of their own activity. An additional 12% assumed partial responsibility for the accident. Only 10% were innocent bystanders; of these, 5% were injured in house fires.

Flammable liquids or powders accounted for 62% of the flame burn injuries: gasoline (35%) and dry explosives (27%) were involved in over 60% of these cases. Considering the extreme hazard presented by these two substances, and the relative inexperience and immaturity of this age group, care should be taken to increase adult supervision and to decrease nosy experimentation with these products. Childish "match-play" is much less common among preadolescents than among the 3-to-8 age group, but matches were used in conjunction with flammable substances in this age group.

Sixty-two percent of these flame burn injuries involved clothing ignition. In contrast to the 3- to 8-year-olds, for whom sleepwear was involved in half the accidents, sleepwear was involved in only 36% of the accidents. Play/daywear was involved in the majority of accidents (60%).

In 28 (out of 42) cases, the victim's first response to the emergency is recorded. The overwhelming majority acted inappropriately, by running, screaming, slapping at the flames with their hands, or doing nothing. Only a few actually dropped and rolled on the ground or in a rug to extinguish the flames.

Six of the children in this sample were interviewed by the project staff:

> A 9-year-old male was burned while reportedly watching friends play with gasoline and throw it on a fire in the woods. (Hospitalized 26 days.)
>
> Another 9-year-old male ignited his clothing while using gasoline to kill ticks on his dog; working with older brother. (Hospitalized 39 days.)
>
> A 9-year-old female was injured while watching her older brother and friends sprinkle a fire with gasoline; gasoline splattered and ignited her bathing suit. (Hospitalized 40 days.)
>
> Another 9-year-old female ignited her nightgown when she climbed onto stove to warm herself; she accidentally knocked the stove control knob to the "on" position. (Hospitalized 22 days.)
>
> A 10-year-old male was burned when a homemade gunpowder bomb was exploded in back yard; playing with two friends. (Hospitalized 6 days.)
>
> An 11-year-old female was burned in house fire caused when her stepfather threw gasoline at his wife in the kitchen during an argument. (Hospitalized 182 days.)

These interviews reveal that adolescent risk-taking behavior is an important factor in burn injuries among preadolescents. The boys were interacting with extremely hazardous materials (gasoline, gunpowder), without taking proper precautions. In three cases (the gunpowder and gasoline/fire play), the children were clearly "playing with danger." One, and perhaps both gasoline/fire play incidents, illustrates a common pattern of accident involving gasoline: a younger bystander (often a girl) is watching boys engaged in fire play, and is injured when splashes of gasoline ignite and land on her. The brothers who used gasoline to remove ticks from the dog had been explicitly forbidden to use gasoline without adult supervision. They had chosen a place which hid their activity from view. Thus, while they could be considered to be working, "playing with danger" was clearly an important factor.

There was no adult supervision in any of these flame incidents, nor was the victim alone at the time of the accidents. In each case, the child was playing with one or more children.

Two of the six flame burn victims in the interview sample responded appropriately to the emergency; the others relied on bystanders to extinguish the flames. The child who exploded the gunpowder bomb dove immediately into a swimming pool to relieve the pain. He had seen his mother treat herself with cold water after being burned with fondue oil several years before, and he followed her example. His quick response might have lessened the severity of his burns; he required only eight days hospitalization.

The girl who was splashed with flaming gasoline had seen someone drop and roll on the TV show "Emergency" just the week before, and she immediately extinguished the flames in that manner.

The four other children relied on bystanders. A 12-year-old friend tackled the other gasoline/fire play victim, and rolled him on the ground, extinguishing the flames. The 14-year-old brother in the dog-and-tick incident acted less appropriately; he tried to beat out the flames with his hands, and sustained second-degree burns to himself. The girl whose nightgown ignited screamed in panic, which brought her father to her assistance. He pulled off her flaming clothing. The child in the house fire tried to run through the flames to reach the apartment's only exit, thereby igniting her clothing. Her 16-year-old brother finally called to her to jump from the third-floor window, after he had thrown a mattress out the window for her to land on.

Three of these victims were treated with cold water as a first aid measure. One mother said she knew about cold water from pamphlets on safety tips which her children had brought home from school.

Other Types of Burns

Only three other types of burns occurred: one contact, one chemical, and one electrical burn. Two victims were hospitalized, both for less than thirty days, with less than 5% of the BSA burned. The number of accidents in this category is too small to allow comparisons by time and place of accident.

One of the patients was interviewed by the project staff:

> An 11-year-old male received an electrical burn when he grabbed a wire which passed through the leaves of the tree he was climbing. (Hospitalized 21 days.)

It is uncertain whether the patient saw the wire before he touched it. However, electrical lines passing through tree foliage constitute a real and present danger, and young tree-climbers should be alerted to the hazard.

During the interview the parents admitted feeling confused about how to best give first aid to their son. They said they knew to put cold water on burns, but because of the nature of his injuries, they were reluctant to do anything without medical advice.

Educational Diagnosis: Middle School—Grade Five

Characteristics of the Fifth-Grade Sample

The sample completing the criterion-referenced test consisted of 212, 10- and 11-year-old fifth-grade students from six school districts in the Boston SMSA (experimental site). The following table describes the experimental sample in terms of the following characteristics: sex, race, burn history, previous burn/fire safety information, and media habits. The table describes the total sample, the 50% subsample (consisting of those students for whom both the open-ended and the multiple-choice questions were coded), and the small sample of interviewed students. The discussion which follows, of the overall scores and subscores, is based on the 50% sample and includes all questions, both open and closed. The discussion of individual items is from the total group.

DEMOGRAPHIC CHARACTERISTICS

	Total Experimental Sample (N=212)			50% Experimental Subsample (N=109)			Interviews (N=18)	
	N	% Total	% Respondents	N	% Total	% Respondents	N	% Total
Sex								
Male	124	58.5	58.5	62	56.9	56.9	9	50.0
Female	88	41.5	41.5	47	43.1	43.1	9	50.0
Race								
Black	1	0.5	0.5	0	0	0	—	—
White	199	93.9	93.9	101	92.7	92.7	18	100.0
American Indian	4	1.9	1.9	3	2.8	2.8	—	—
Other	8	3.8	3.8	5	4.6	4.6	—	—
Burn History								
No Answer	9	4.2	—	4	3.7	—	—	—
Never Burned	46	21.7	22.7	23	21.1	21.9	8	44.4
Mildly Burned	142	67.0	69.9	75	68.8	71.4	10	55.6
Severely Burned	15	7.1	7.4	7	6.4	6.7	—	—
Type of Burn								
Hot Liquid	53	25.0	33.8	24	22.0	29.3	—	—
Electrical	46	21.7	29.3	26	23.9	31.7	—	—
Open Flame	41	19.3	26.1	20	18.3	24.4	—	—
Contact	108	50.9	68.8	56	51.4	68.3	—	—
Flammable Liquid	3	1.4	1.9	1	0.9	1.2	—	—
Other	9	4.2	5.7	—	—	—	—	—
Don't Know	13	6.1	8.3	—	—	—	—	—
Fire Safety Information								
No Answer	2	0.9	—	1	0.9	—	0	—
No	12	5.7	5.7	6	5.5	5.6	0	—
Yes	198	93.4	94.3	102	93.6	94.4	18	100.0
Safety Information								
Where								
Fire Department	96	45.3	48.5	48	44.0	47.1	2	11.1
TV	57	26.9	28.8	29	26.6	28.4	5	27.8
Movies	25	11.8	12.6	12	11.0	11.8	2	11.1
Teacher	42	19.8	21.2	27	24.8	26.5	3	16.7
Scouting	75	35.4	37.9	39	35.8	38.2	3	16.7
Work	2	0.9	1.0	2	1.8	2.0	—	—
Booklets	61	28.8	30.8	31	28.4	30.4	—	—
Parents	119	56.1	60.1	63	57.8	61.8	3	16.7
Other	1	0.5	0.5	8	7.3	7.8	—	—

The table indicates that the characteristics of the 50% subsample and of the interview subsample are representative of the total experimental sample.

In the 50% sample there are slightly more boys than girls. Most of the students are white; less than 10% are from minority groups. Almost 95% have received some fire safety information, mainly from their parents or local fire department. Other sources mentioned frequently are scouting, assorted booklets, and television. Over 75% reported that they had been burned, with 69% being mildly burned at some time, and 6% receiving severe burns which required treatment by a physician.

Media Habits

As shown in the following table, fifth graders are great consumers of media, especially television--over 80% watch it every day of the week. At any given time of day, more fifth graders are watching television than listening to the radio. Evening is the most popular time for both watching television and listening to the radio; early morning is next in popularity.

MEDIA HABITS

	N	% Total	% Respondents
Days/ Watch TV			
None	7	3.3	—
Saturday	200	94.3	97.6
Sunday	177	83.5	86.3
Monday	181	85.4	88.3
Tuesday	190	89.6	92.7
Wednesday	192	90.6	93.7
Thursday	187	88.2	91.2
Friday	194	91.5	94.3
Time/TV			
6-8 AM	88	41.5	42.9
8-10 AM	73	34.4	35.6
10-12 AM	48	22.6	23.4
12-2 PM	50	23.6	24.4
2-4 PM	91	42.9	44.4
4-6 PM	146	68.9	71.2
6-8 PM	163	76.9	79.5
8-11 PM	137	64.6	66.8
after 11 PM	29	13.7	14.2
Time/Radio			
Don't Listen	43	20.3	—
6-8 AM	66	31.1	39.1
8-10 AM	22	10.4	13.0
10-12 AM	16	7.5	9.5
12-2 PM	25	11.8	14.8
2-4 PM	56	26.4	33.1
4-6 PM	63	29.7	37.3
6-8 PM	60	28.3	35.5
8-11 PM	68	32.1	40.2
after 11 PM	24	11.3	14.2

Nature and Extent of Knowledge

This section summarizes "how much and what kinds" of information youngsters from the experimental group exhibited in terms of total score and of three domains--type of knowledge, type of burn, and type of product. This discussion is based on the 50% subsample.

Total Scores on the Criterion-Referenced Test

The distribution of scores on open and closed items is illustrated on the following page. An examination of the distribution curve indicates that out of a possible 90 points on the test, scores ranged from 19 to 62 with a general tendency for scores to cluster near the middle. The mean score was 42 with a standard deviation of 7.35.

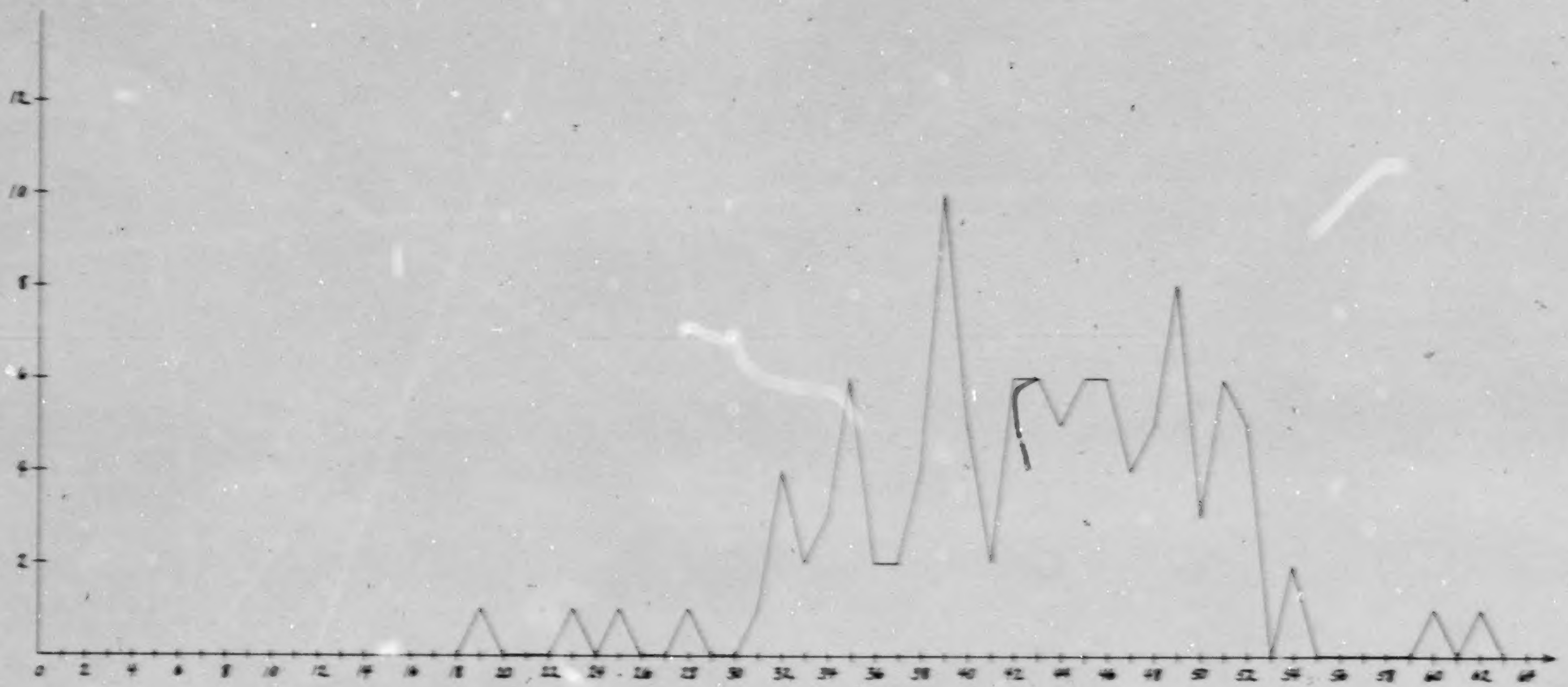
When scores are recoded, they distribute evenly across four categories.

Recoded Scores	No. of Items Correct	Standard Deviation from the Mean	% Students
Low	0-38	½ or less	25.7
Low Average	39-42	0 to -½	21.1
High Average	43-46	0 to +½	21.1
High	47 and over	+½ or greater	32.1

Boston - Grade 5 - 1976

Total Test Score (Open and Closed)

N = 109



Domains and Related Subscores

The organizing domains and their related subscores for fifth graders follow:

DOMAINS AND RELATED SUBSCORES

	Total Possible Score	Average % Correct
ALL ITEMS	90	47
Type of Knowledge		
Behaviors to Minimize Harm	7	57
General Awareness	41	49
Preventive Behaviors	28	45
Facts and Concepts	19	40
Type of Burn		
Flame	44	52
Smoke	3	49
Contact	6	47
Electrical	9	46
Chemical	5	35
Scald	12	30
Type of Product		
Electrical Sources	6	58
House Fires	3	55
Flammable Liquids	17	53
Space Heaters	3	52
Matches/Smoking Materials	14	51
Ovens/Ranges	6	50
Fireplaces	4	34
Flammable Fabrics	13	28

As the data indicate, the average percent correct for fifth graders was rather low (47%) for all items, particularly when compared with that of first graders (72%). In terms of type of knowledge, fifth graders ranked highest (57%) on items related to behaviors to minimize harm once a burn is in progress. General awareness of the causes and consequences of fires and burns ranked second highest (49%), while knowledge about preventive behaviors and underlying facts and concepts ranked lowest (45% and 40%, respectively).

When scores were arranged by type of burn, knowledge related to flame ranked highest (52%), while that of smoke (49%), contact (47%), and electrical (46%) clustered in the second highest position. Scores for chemical burns and scalds clearly ranked lowest for this age group (35% and 30%, respectively).

A consideration of knowledge by type of product revealed that all students scored highest when electrical sources (58%) and house fires (55%) were involved. Closely grouped together were flammable liquids (53%), space heaters (52%), matches and smoking materials (51%), and ovens/ranges (50%). Outstandingly low is knowledge associated with fireplaces (30%) and flammable fabrics (28%).

Individual Items

Using the same criteria established previously (over 85% correct = high; 65 to 85% = medium; and less than 65% correct = low), most items on the criterion-referenced test (100% sample) fall into the low category. More than twice as many items (38) fall in the low category than in the medium and high categories combined (17).

Fifth graders were generally unaware of the properties of flammable liquids, unable to identify the potential dangers when storing them, and did not know what to do if a flammable liquid spilled on them. They scored low on items related to principles of combustion and electrical conductivity; fifth graders are unaware of the dangers common to their age group from flame and electrical burns. For example, they did not know:

- That matches and lighters are the most common cause of burns among younger children (3- to 9-year-olds).
- The length of hospitalization often associated with severe burns.
- The injuries associated with high voltage wires and utility pole accidents.
- The risks in using space heaters.

Several items related to scalds also fall into the low category. Fifth graders did not know how to position pots safely on a stove or how to treat scalds if they occur.

Although unaware of the high risk involved in using matches, fifth graders did moderately well on most items focusing on behaviors to prevent flame burns caused by matches, lighters, or a fireplace. A moderate number knew how to assist a friend whose clothes are on fire.

All items falling into the high category involved behaviors (on the part of the student or an adult). Despite their lack of knowledge about storage of flammable liquids, most fifth graders could identify the potential dangers of using flammable liquids—i.e., smoking near turpentine, refilling a lawn mower which has just been in use, or pouring starter fluid on a burning barbecue. Fifth graders also knew they should never use a fork and toaster together. The item answered correctly by the greatest percentage of fifth-grade students (93%) was to "drop and roll" if clothing catches on fire.

Facts and Concepts

As indicated, facts and concepts ranked lowest among the four kinds of knowledge exhibited by fifth graders. Virtually all of the items related to this subscore classified as low. The discussion which follows centers on fifth graders' concepts about spontaneous combustion, flammability, and electrical conductivity.

TYPE OF KNOWLEDGE—FACTS AND CONCEPTS

Question Number	Objectives	Type of Burn	Type of Product
HIGH —	—	—	—
MEDIUM 17(16)	Recognize properties of flammable liquid.	Flame	Flammable Liquid
37	Identify principles of electrical conductivity.	Electrical	Electrical Sources
LOW 20	Identify some common flammable liquids.	Flame	Flammable Liquid
24,25 26,27	Deduce cause-effect principles of combustion.	Flame	Flammable Fabric
39	Identify definition of flame-resistant fabrics.	Flame	Flammable Fabric
17(17) 17(18) 17(19) 19	Recognize properties of a flammable liquid (can burst into flame if kept in hot closed space, touches hot object, left in hot sun).	Flame	Flammable Liquid
45	Recognize conductors of electricity.	Electrical	Electrical Sources
46	Recognize that electrocution is a function of grounding.	Electrical	
31	Explain that metal is an excellent conductor of electricity and can cause severe shock if put in a source of electrical current.	Electrical	Electrical Sources
28	Identify materials that will combust spontaneously.		
21	Identify some caustic substances.	Caustic	

In response to the open-ended item, "What do the stacks of newspapers and bundles of hay have in common?" almost 80% cited at least one correct answer--usually, "will burn or catch fire." The specific idea of spontaneous combustion was mentioned, however, by only 4% of the students (i.e., "will burn if left in a hot place," or "can burst into flames on their own"). Almost 20% indicated that no danger or hazard was involved.

About half of the students knew that flammable liquids would burst into flame if kept in hot closed spaces, and 25% knew they would burn if in contact with a hot object or if left in the hot sun. A majority of students could identify common flammable liquids (airplane glue, charcoal starter, nail polish remover, liquid fuel) but only 37% could identify caustic substances which are sources of internal burns (bleach, drain opener, dishwater detergent, window cleaner).

Few students could define flame-resistant fabrics. About 75% defined flame resistant incorrectly, saying it meant "will not catch fire." Only 9% indicated correctly that flame-resistant fabrics will stop burning when the flame is removed.

Students also did poorly on items related to identifying principles of electrical conductivity (i.e., that electricity will pass easily through water and copper and that electrocution is a function of grounding). When asked why you should not use metal (fork) with an electrical source (toaster) only 63% of the fifth graders cited a correct reason; the majority of this group (72%) indicated you could electrocute yourself (shock/electrical burn) if you put the fork inside. Only 2% mentioned the concept of the fork conducting electricity.

Two concepts were answered moderately well by students. One involved a fairly obvious property of flammable liquids (they can easily be set on fire by sparks and flames) and one referred to electrical conductivity (electricity passes through your body more easily when you are wet).

No items related to underlying facts or concepts could be classified in the high category.

Preventive Behaviors

Preventive behaviors ranked third among the four types of knowledge. Items in the low group related primarily to proper techniques for preventing flame burns caused by flammable liquids and flammable fabrics, and for preventing scald burns near ovens and ranges. (See following table.)

TYPE OF KNOWLEDGE—PREVENTIVE BEHAVIORS

Question Number	Objectives	Type of Burn	Type of Product
HIGH	Recognize that to prevent burns one should:		
31	Never use metal objects (e.g., fork) with a source of electricity.	Electrical	Electrical Sources
MEDIUM	Recognize that to prevent burns one should:		
38	Not stand close to a space heater, open fire, or stove to warm up.	Flame	Fireplaces/Space Heaters
49(54) 49(56) 49(57)	Close the match cover before lighting a match; hold the match away from your face; think only about what you're doing.	Flame	Matches/Smoking Materials
LOW	Recognize that to prevent burns one should:		
51(1)	Keep matches locked up away from small children.	Flame	Matches/Smoking Materials
51(3)	Extinguish matches with cold water before throwing away.	Flame	Matches/Smoking Materials
30	Carefully prepare an open fire site; extinguish fire completely with sand, dirt, and/or water before leaving.	Flame	Fireplaces
48	Use heavy, wooden, box matches.	Flame	Matches/Smoking Materials
40	Wear tightly woven fabrics (denim) or animal fibers(wool) when working near open flame.	Flame	Flammable Fabric
29	Not take an open flame inside a tent.	Flame	Flammable Fabric
23	Remove clothing on which a flammable liquid has spilled.	Flame	Flammable Liquid
16	Store gasoline in a tightly capped metal container with a pressure-release valve.	Flame	Flammable Liquid
34	Plan an outside meeting place as part of a fire drill.	Flame	House Fire
54(2) 54(3)	Turn the handle of a pot inward when cooking on the stove.	Scald	Ovens/Ranges
13	Work with chemistry sets only under adult supervision; never mix unknown chemicals; follow directions explicitly.	Chemical	

Only one in five students (21%) recognized that one should not pour flammable liquids (gasoline) into a hot machine (lawn mower). Rather than wait an hour to add gas, the majority of students (54%) checked "move the mower out of the sun and add gas."

Also, students failed to recognize that gasoline should be stored in a tightly capped metal container with a pressure release valve; most students (68%) thought that a metal container with a cap would suffice as a safe storage container.

When asked what to do if a flammable liquid (model glue) were spilled on a shirt, about 62% of the students responded correctly (take off the shirt), but many students (25%) said "wipe it with a wet sponge" (which does nothing about the flammable vapors).

When asked an open-ended question about two important things all children should do to prevent being burned when using a chemistry set, almost half of the fifth graders (49%) gave no answer. Another 46% gave one correct rule, and only 20% correctly stated two preventive behaviors. Most frequent responses were "use under adult supervision" (44%), and "use properly and follow directions" (19%). Fewer students indicated, "wear protective clothing such as gloves or mask" (14%), "a flame should not be used near flammable liquids" (10%), and "use in well-ventilated area" (4%).

Items related to the relative burning speed of common fabrics also fell into the low category. Only 26% of the students correctly identified jeans and a wool sweater as the most fire-safe clothing if one did not have flame-resistant clothing. Approximately the same number checked jeans and a cotton shirt, or corduroy pants and a cotton shirt, both of which are much less safe.

Interestingly, less than half of the students (45%) correctly identified how to position pots safely on a stove (handles should not hang over the edge of the stove--a common cause of scalds). Another low item was recognition of the safest type of matches: 59% correctly checked the box of matches, but 26% indicated that a book of matches is the safest.

When asked to write a fire safety rule associated with tents, slightly over half (55%) gave a correct rule: most commonly "do not build a campfire near a tent" (48%) or "do not use open flame (e.g., candle, kerosene lantern) in a tent" (28%). Less frequent responses included "do not smoke or burn incense in a tent" (6%), and "do not store flammable liquids in or near a tent" (1%).

When asked to complete the sentence, "Matches should be kept __________," about one-third of the fifth graders identified the preventive behavior "away from children." Another third wrote a more general statement--"in a safe place"--without identifying where that might be. Less than 5% said "closed when lighting," "away from flammable liquids, rags, or paper," "in a cool place," or "locked up."

"Before throwing away matches, you should __________," elicited responses such as "be sure they are completely out"

(71%), or "make sure they are all used" (23%). Most students did not specify how to make sure they are out or all used; only a few said, "run under water" or "blow them out."

Less than half of the students (43%) knew that the most important part of a home fire drill is to have an outside meeting place after escape. An equal number of children felt the most important consideration is to plan how to go back into the house to rescue someone.

Moderately well-understood preventive behaviors included: wrapping a blanket around you as the best way to keep warm (as opposed to coming close to a stove, fireplace, or space heater), and striking matches correctly. When asked for campfire safety rules, 83% could write in at least one rule, and 13% gave two correct rules. The most common responses were to extinguish a fire completely (34%) or don't leave a fire unattended (33%). Less than 10% said to keep fire under control (and small); to use a prepared site; not to build a fire near trees, roots, etc.; not to put paper or leaves on a fire; and to keep small children away from campfires.

The only preventive behavior that most fifth graders knew quite well was never to use metal objects with a source of electricity (toaster). This item was answered correctly by 93%.

Fifth graders did poorly in identifying how flammable liquids (gasoline) could cause harm by explosion in unventilated areas (basement, trunk of car) or near open flames (gas heater). However, they did moderately well in identifying situations having proper ventilation (open window) and recognizing burn prevention techniques for using gasoline or turpentine. They did very well in identifying potential dangers involving flammable liquids (smoking while using turpentine; filling a hot lawn mower with gasoline; adding gasoline to a burning barbecue; storing gasoline near a gas heater with an open flame).

General Awareness

General awareness items ranked second highest overall. As shown in the following table, students did poorly in recognizing the most common causes of burns for younger children ages 3 to 9 or understanding the consequences of being burned.

TYPE OF KNOWLEDGE—GENERAL AWARENESS

Question Number	Objectives	Type of Burn	Type of Product
HIGH			
50(1) 50(2) 50(3) 50(5)	Distinguish between situations which may cause harm due to using flammable liquid near open flame or heat source in unventilated area and those that will not.	Flame	Flammable Liquid
51(2)	Recognize dangerous consequences of playing with matches.	Flame	Matches & Smoking Mat.
MEDIUM			
50(7) 50(8)	Distinguish between situations which may cause harm due to using flammable liquids near open flame or heat source in unventilated area and those which will not (recognize safe situations).		Flammable Liquid
43a	Given a kitchen scene, identify common situations which may cause a scald and explain why.	Scald	
LOW			
9	Recognize matches and lighters as a major cause of burns for the 3-9 age group.	Flame	Matches & Smoking Mat.
51(4)	Recognize that cigarette lighters are hazards due to adjustability of the open flame.	Flame	Matches & Smoking Mat.
15	Acquire knowledge of increased burn severity when flammable fabrics are involved.	Flame	Flammable Fabric
55	Given a living room scene, identify fabric ignition as a risk of using an unscreened fireplace.	Flame	Flammable Fabric
42a	Given a kitchen scene, identify causes of burn injury, i.e., fabric ignition, due to loose towel, loose fitting sleeves, and explain why.	Flame	Ovens/Ranges
44	Identify causes of burns associated with storing pressurized cans near heat, cookies over stove.	Flame	Flammable Liquid
50(4) 50(6)	Identify situations which may cause harm due to using flammable liquid near open flame or heat source in unventilated area.	Flame	Flammable Liquid
52(2) 52(3)	Recognize usual result of high voltage accidents.	Electrical	
55	Given a living room scene, explain why running an extension cord under a rug is hazardous.	Electrical	Flammable Fabric
47(48) 47(49) 47(50)	Recognize risks of using an electric space heater.	Electrical Contact	Space Heaters
14	Recognize correct placement of cooking pots on burner.	Scald	Ovens/Ranges
4	Recall the phone number of their local fire department by memory.		
10 11,12	Recognize the prolonged recovery period and permanent deformity caused by severe burn injuries.	Chemical	

Students' attitudes toward matches were shown in their response to a sentence-completion item: "Playing with matches is __________." About three-fourths of the students replied "dangerous, unsafe" or indicated that matches are potentially harmful; another 25% said "foolish, bad, wrong." Only about 27% recognized matches and lighters as a common cuase of burns for younger children. A substantial number incorrectly thought that hot pots, electrical outlets, and barbecues or open fires posed the greatest danger (28%, 17%, 14%, respectively).

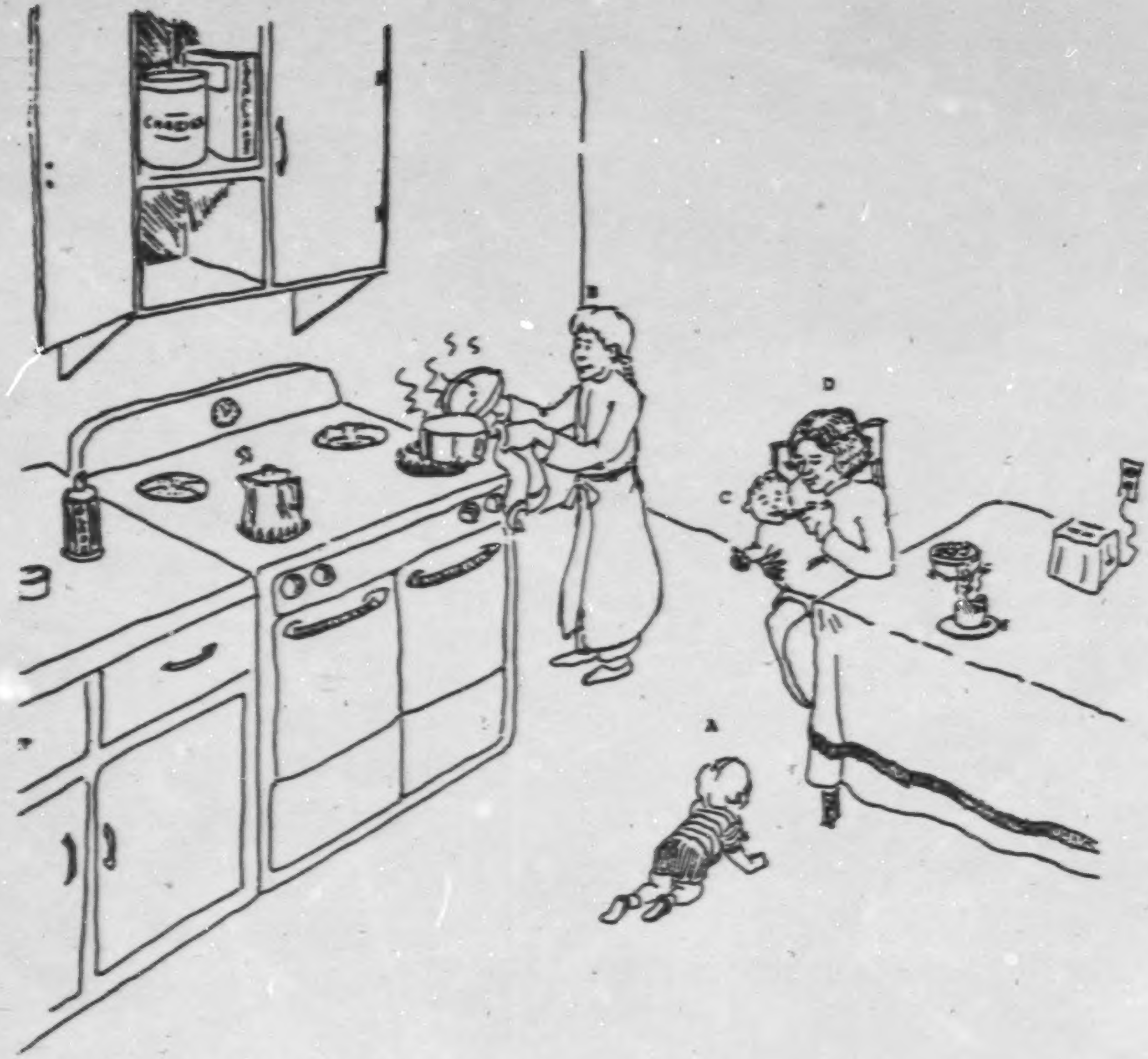
When asked to complete the sentence, "The special danger of cigarette lighters is __________," only two-thirds of the students responded. Of the respondents, about 20% stated very generally "you could burn yourself." Another 25% indicated that the fuel is dangerous (but less than 2% said why it is dangerous). Sixteen percent indicated that the flame is dangerous (but less than 10% gave a reason, i.e., "it is adjustable," "fingers can touch the flame," or "can ignite clothing").

Fifth graders were not aware that burns are more severe when flammable fabrics are involved. When asked whether a boy with long cotton pants or a boy wearing shorts would be burned more severely if a spark landed on the boy's leg, only 27% said the boy with long cotton pants would be burned more severely. The majority (57%) thought the reverse would be true.

In terms of burn consequences, few students knew that high voltage accidents usually result in bad scars (24%) or loss of arms and legs (11%). The majority (56%) said a mild shock would result from an accident involving climbing a utility pole and having the electricity arc from the pole to hit you.

Fifth graders also did not recognize the prolonged recovery period and permanent deformity of severe burn injuries (third-degree burns over half of the BSA, including face, from a chemistry set). Almost half of them thought hospitalization would last four to eight weeks rather than the actual 33 or more weeks.

Risks associated with the use of space heaters (electric shock, setting clothes on fire, or burns from touching it) were also found in the low category. When students were presented with a kitchen scene (see following page) and asked to identify two things that might cause a burn and why, about 25% marked two sources and gave the proper explanation for each. The specific item recognized most easily as dangerous was the pan held by the girl. The towel being used


B
D
C
A

on the handle of the pan, the coffeepot located on another burner, the burner itself, and the lid held by the girl were recognized less often. Clearly unnoticed as potential dangers were the loose sleeves and robe worn by the girl, and the aerosol can located near the stove. The reasons students gave for checking why that item might cause a burn were generally that the item might ignite or that hot liquid might spill. Fewer students mentioned getting burned by actually touching the hot pan or burner, and very few said that a fabric could be ignited (either the towel or the girl's clothing).

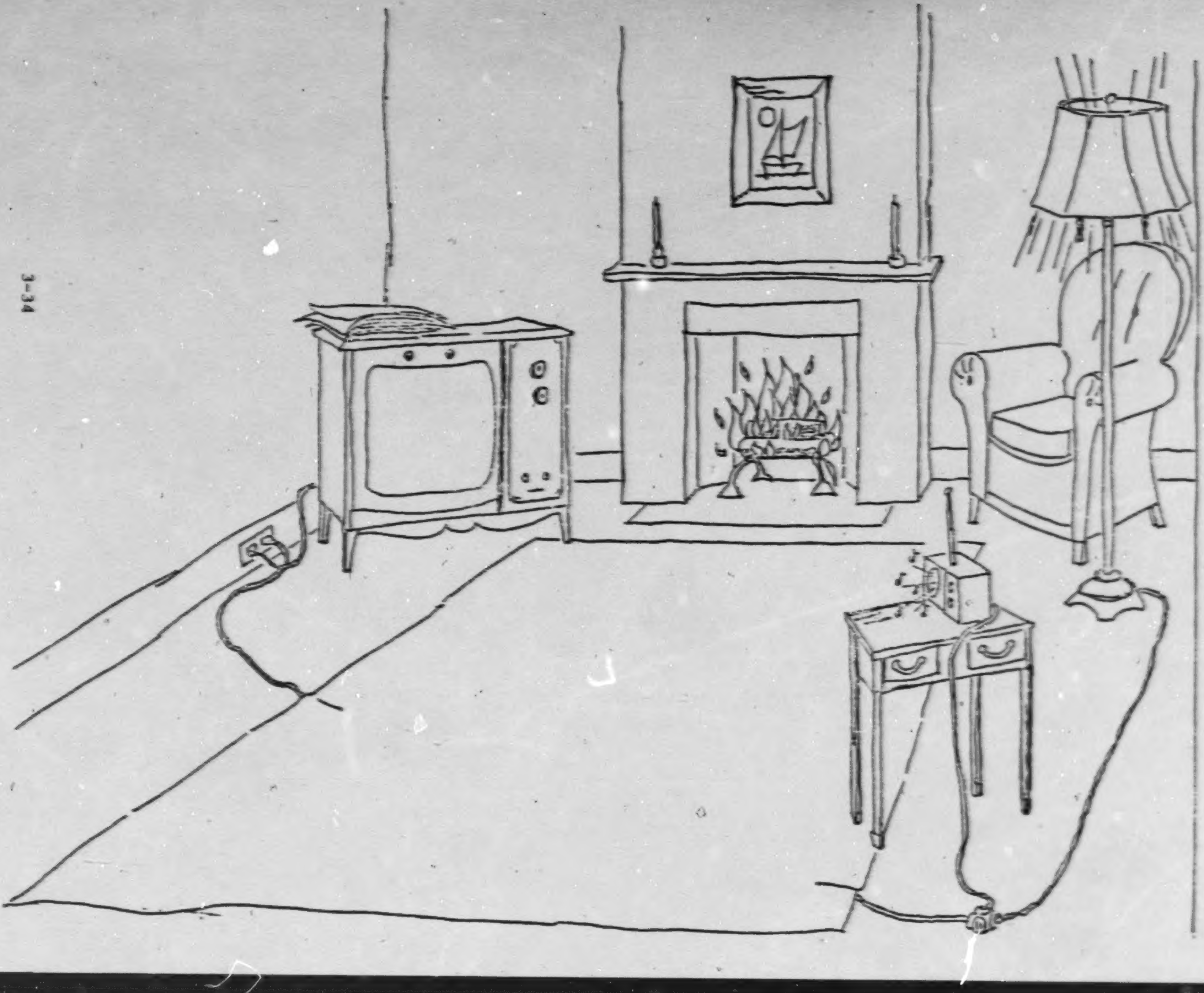
When asked about items which could cause a burn to the baby being fed at the kitchen table covered by a cloth or the youngster crawling on the floor near the table, students most frequently marked the cup filled with hot coffee, saying it would spill. Far fewer identified objects like the stove itself, the pan held by the girl working at the stove, or the tablecloth which could be pulled down by the toddler, also resulting in a scald from the coffee cup.

When shown a picture of a living room (see following page) and asked to check three potential fire or burn hazards, about 80% of the students checked three or more items. However, over one-third of the items they checked are not actually presented as hazards in the picture (lamp, candles, TV cord, TV, rug, etc.). The most frequently checked hazardous items were: an unscreened fireplace (25%); extension cord socket (18%); cord under the rug (14%); and papers on the TV (8%).

Behaviors to Minimize Harm

Fifth graders did best on items related to minimizing harm once a fire or burn is in progress. An examination of the individual items within this domain reveals that the majority of items fall in the high or medium groups, as seen on the following table.

3-34



TYPE OF KNOWLEDGE—BEHAVIORS TO MINIMIZE HARM

Question Number	Objectives	Type of Burn	Type of Product
HIGH	Recognize that to minimize harm once a burn or fire is in progress one should:		
32	Drop and roll to extinguish flames.	Flame	Flammable Fabric
MEDIUM	Recognize that to minimize harm once a burn or fire is in progress one should:		
22	Not try to put out fires oneself; seek help from an adult or the fire department.	Flame	
41	Tackle a person who panics and runs because of burning clothing.	Flame	Flammable Fabric
33	Crawl when moving through smoke.	Smoke	House Fire
LOW	Recognize that to minimize harm once a burn or fire is in progress one should:		
35	First remove clothing on which a hot liquid has spilled.	Scald	
36	Apply cold water to a scald after clothing has been removed.	Scald	
55	Yell from the window if caught in the bedroom during a house fire.		House Fire

Students did least well in identifying behaviors related to treatment of severe scalds and to avoidance of smoke inhalation during a house fire. When asked what to do first if you spill a cup of hot milk on your pants, about one-third of the students said they would take off their wet clothes. A similar number said they would run the burn under cold water (31%) or put lotion or butter on the burn (24%). When asked what to do next, only 25% said they would run the burn under cold water. A greater number said they would put lotion or butter on the burn (28%) or wrap a clean sheet around the burn (27%). When asked how to avoid smoke inhalation, 42% said they would yell from the bedroom window if they woke up in the night and found a room full of smoke. A greater percentage (47%) said they would try to get out in the hallway.

About 75% of the students knew that if you are standing near a friend whose clothes catch on fire, and he panics and runs home, you should tackle him and throw him to the ground. However, 16% said you should get a bucket of water. Similarly, about 75% recognized that young children should not try to put out fires; rather they should seek help from an adult or the fire department. And although students did poorly in identifying correct behavior to avoid smoke inhalation during a house fire, they did moderately well (77%) in responding how to move through smoke (crawl out). Only 15% said to run out.

Most fifth graders recognized the correct steps for extinguishing burning clothes. Over 85% knew that if your clothing catches on fire you should "drop and roll." However, another 10% said you should tear off your clothes quickly and 5% said to run and get a blanket.

Interviews with Fifth-Grade Students

Interviews with eighteen fifth graders generally confirmed findings from the criterion-referenced test. Additional insights into the knowledge, attitudes, and behaviors of fifth-grade students were also revealed. The following discussion is organized around topical areas discussed with the students and, to the extent possible, uses the words of the students themselves.

Matches

When asked, "In what ways do most children your age get burned?" almost one-half of those interviewed said matches and lighters caused most of the burns. Most of the others mentioned stoves. Most children simply identified the cause and did not explain why it was a cause. Others spoke of the "attraction" of matches:

> Fooling with matches, playing around, saying, "Hey, I'm great, look at this match--(explosion-type noise)--whole place gets burned down."

All but one child had been taught to light matches by their parents. About one-third of the children had lit matches themselves. Only two admitted doing it just for the sake of doing it.

> My mother said I could light the candles for my sister's birthday cake.

> Yes...to light my cigarette.

When asked what kind of matches they would use, about one-quarter said box-type matches, and another quarter indicated book matches. Could these fifth graders get a match without an adult? About half replied in the affirmative:

> Well, sometimes yes, cuz like the gas goes out, I just take a match and...(relight the pilot light).
>
> Yeah...in the pantry, there's a little bottle....
>
> No...they don't want me fooling around with matches.
>
> My parents say don't touch them.

Bathtub Scalds

When asked if they thought bathtub water from the tap could burn you badly enough to make you stay in a hospital for a month, only half said yes, giving such responses as:

> One of my mother's friends' sister, her baby was in the tub and she turned it on really hot and the baby came out nearly burned to death.
>
> If you put boiling hot water and you just jump in, you burn.
>
> Yes...once I got burnt because I forgot to turn the cold water on...(what happened?)...I turned red.

Electrical Burns

The danger of electrical burns by putting fork and toaster together was answered correctly by all students. When asked why, most seem to know of electrocution or shock as a result:

> ...Cuz if you touch with the fork while the toaster was on inside you'd get electrocuted...you get burned sort of, shocked...bad...(enough to go to the hospital?)...I suppose so.

Some also knew about electrical conductivity:

> The electricity could go through the metal into you...probably get killed or a shock.
>
> The fork carried electricity because it's metal... burns you, pretty bad.

But one student said simply:

> I wouldn't do it, I'm not stupid...(what would happen?)...you'd probably break the toaster.

When asked about climbing utility poles on a dare, only one child said he would; he thought the wires were safe because they were insulated. Most mentioned falls and electrocution if you came in direct contact with the wires.

> If I did it, I'd probably get hurt...if I fell. Could get height sick...if you touched the wires, it's hot.

> Wouldn't climb it cuz you could get electrocuted and burned by electricity if you touched the wires.

Stoves

With reference to getting cookies stored over the stove, all fifth graders interviewed correctly checked the picture where the child is asking the mother to get them:

> Ask her...this one is very dangerous (referring to a child trying to get it with a chair or kneeling on the stove)...cookies could fall all over the place...we have a gas burner and there's a little thing there that's always lit and your pants could catch on fire.

> Could hit the burner...burn his leg.

In terms of proper clothing to wear when working at the stove, about 75% checked the proper outfit. Most said that "longer sleeves or bows and things could catch fire," but a few gave as a reason, "the others were dressy clothes." Those who chose the wrong outfits said they did so because in one picture the girl was wearing an apron or because "bare arms could be burned so longer sleeves are better." When asked if they ever cook when there is no grownup around, about 25% said they did--usually making eggs at breakfast. One student uses a microwave oven.

Flammable Liquids

Two-thirds of those interviewed could define flammable liquids and name two of them. Most of them saw the prime hazard to be a flame coming in contact with the liquid and causing an explosion. Almost no one expressed the idea that the vapors could be ignited or that the flame does not necessarily have to come very close to the liquids themselves for them to blow up.

When asked if they had ever used a power mower, about 25% had. Three mentioned that the mower should cool before refilling. One student mentioned a minibike, and gave the same precaution.

> Shut the power mower off...go in the house...tell my father...he would take care of it the rest of the way.

> Let it cool off, in the shade, and then pour the gas in....
>
> Took it over underneath a tree and filled it up... (anything else?)...let it cool off...cuz it would just be so hot the gasoline would catch on fire.
>
> Ran out of gas using my motorbike...walk it back... fill it up again...(anything else?)...wait until it cools off...it might be heated up and blow up.

Chemical Burns

Only about 10% of the children interviewed had chemistry sets. Those who did mentioned safety precautions they knew about but did not practice:

> Have a grownup tell you where to put the stuff.
>
> Wear gloves and a mask.

Two children had actually been involved in minor explosions:

> We made a bomb and that was dangerous; we threw it and the thing blew up...we put chlorine in it...my mother was upstairs...I told her afterwards. (The directions for the bomb were in the chemistry set, according to this child.)
>
> When I mix stuff up...it almost blew up...(do you ever mix stuff together just to see what happens?) ...I did that twice, the first time it almost blew up, the second time it didn't do nothing...(Have you ever heard about kids getting hurt from doing that?)...Yes, from blowing up in their face.

Fires

When asked about being near people working or playing with fire, the children talked about kids playing with fires and firecrackers in the woods, about cookouts and fireplaces, about using a torch to fix hockey sticks, and about a father or workmen using a soldering torch in the home:

> One time there was the guy come to fix the water pipe and he had the gas thing (solderer).
>
> Just last month up in the woods they had a war with fireworks...and they had this tube and they put the bottle rocket in and they just aimed it and (shooting noise)...(and you shoot it at each other?)...yeah, shoot up in the air and it will blow up right near 'em, but the bottle rockets

> couldn't hurt you, cuz it...landed about there... they just jump....
>
> ...been near some kids lighting firecrackers with matches.

One student knew a kid who set some fires that resulted in houses burning; he also admitted to sending in three false fire alarms himself. When asked about a fire exit plan for the family, only one child said they did not have a way to get out in case of fire. However, only one child had actually practiced getting out (and also had a fire and smoke detector system in the home). Typical responses included:

> [Father put in a] fire alarm system...stay down low...tie a sheet like that and climb down if it's high...but I can just jump out of my window....
>
> Yup, there's this back door...and it's a cellar door, all brick around it so that can't get to the fire...(practiced?)...No.
>
> We have a lot of doors to get out.... No, we don't really have to practice, our windows are close to the ground in the back yard.
>
> We have porches in the bedroom...(practiced?).... No, I'd be scared to get out on the porch.

When asked if they had ever tried to put out a fire alone, almost one-third of the students said yes. Typically they had tried to "stamp" out outdoor fires:

> We kept stepping on it, he told me to put dry leaves on it and that would put it out...it kept going...said, "Is this right?" and I kept stepping on it.
>
> We all tried to put it out.... Everybody ran over and started jumping around and stamping on it....
>
> Campfire...then we take a whole mess of water on it...then we kick dirt on it.

Is Knowledge Related to Selected Sample Characteristics?

For the fifth-grade sample, overall burn/fire prevention knowledge (using mean scores) was analyzed by school district, sex, and burn history. The only significant relationship was between boys and girls (although the mean scores for overall knowledge differed by only two points, with the boys scoring higher). Interestingly (but not significantly), children who had been burned mildly at one time tended to do somewhat better than those who had been burned severely or never burned at all. Since most of the sample reported that they had previously received some form of burn/fire prevention instruction, a comparison on this dimension was not possible.

Relevant data follow.

Knowledge by School District

An examination of the mean scores across individual school districts in the experimental site revealed that the overall extent of knowledge about burns tended to be the same.

Overall Scores by School District

School District	N	Mean Score*	Standard Deviation
For entire population	109	42.6	7.4
1	18	44.1	6.5
2	20	39.8	8.1
3	26	41.0	6.9
4	22	44.0	6.5
5	23	44.4	7.9

*An ANOVA test resulted in failure to reject the H^{O} at level $\alpha = .05$.

Knowledge by Sex

There were small but statistically significant differences between boys and girls in their overall knowledge about burns.

Overall Scores by Sex

Sex	N	Mean*	Standard Deviation
Boys	62	43.6	7.2
Girls	47	41.2	7.4

*A t test resulted in rejection of H^{O} at level of $\alpha = .05$.

In comparing the recoded scores of boys and girls, more girls than boys fell into the low category, and fewer girls fell in the high category. However, the differences were not significant.

Recoded Scores by Sex*

Sex	N	Low	Low Average	High Average	High
Boys	62	3%	34%	48%	15%
Girls	47	17%	38%	38%	6%

*A chi-square test resulted in failure to reject the H^o at level of α = .05.

Significantly, the subscores for girls were lower than boys for facts and concepts within the type of knowledge category: for electrical burns within the type of burn category; and for electrical sources and flammable liquids within the type of product category.

KNOWLEDGE BY SEX
(expressed in average percent correct)

	Male	Female
ALL ITEMS	49	46
Type of Knowledge		
Facts and Concepts*	44	36
General Awareness	49	48
Preventive Behaviors	46	44
Behaviors to Minimize Harm	59	54
Type of Burn		
Flame	52	52
Contact	46	50
Electrical*	49	43
Chemical	37	34
Scald	31	28
Smoke	52	45
Type of Product		
Flammable Fabrics	29	26
Flammable Liquids*	56	46
Space Heaters	49	55
House Fires	33	35
Matches/Smoking Materials	50	53
Ovens/Ranges	49	51
Electrical Sources*	63	51
Fireplaces	33	35

*A t test on raw scores resulted in rejection of the H° at level $\alpha = .05$.

Knowledge by Burn History

Somewhat surprisingly, there was no significant relationship between knowledge and previous burn experience. However, students who had received mild burns tended to score better than those who had been severely burned or not at all.

Overall Scores by Burn History

Burn History	N	Mean Score*	Standard Deviation
SEVERELY BURNED (badly enough to go to a doctor or hospital)	7	42.7	7.7
MILDLY BURNED	75	43.3	7.6
NEVER BURNED	23	40.2	6.4

*An ANOVA test resulted in failure to reject the H^{O} at level of $\alpha = .05$.

Adolescents
13 to 19 Years of Age

Summary: Adolescents 13 to 19 Years of Age

The adolescent population comprises 15.5% of the state burn incidence data, while this same group comprises 12.8% of the Massachusetts population. The incidence data indicate that the scald burn continues to be the most frequent (41%). Although the most frequent scalds continue to involve kitchen accidents, scald burns reflect the increased variety of work and play activities of this age group (auto radiator scalds, industrial process scalds, hot chemical scalds). Chemical, radiation, and electrical injuries are represented least frequently in this sample, comprising less than one-sixth of burn accidents. Flame burns account for 28% of the injuries to this age group, and often involve flammable liquids. Causes of flame burns include kitchen accidents involving improper methods of lighting gas stoves, and outdoor accidents involving misuse of gasoline, such as smoking while working with gasoline, or adding gasoline to an existing fire. Male adolescents are more often injured than females.

The profile data on adolescent burn victims in the Boston SMSA allow certain generalizations:

- Flame burns are generally the most severe, involving more hospitalizations, a longer hospital stay, and a greater extent of burn.
- Clothing ignition is a significant factor in serious burn injuries, with outer wear rather than sleepwear involved in the majority of burns in which clothing was ignited.
- The response to clothing ignition is panic, involving running and screaming, so that bystanders must be relied upon to extinguish flames.
- Different accident patterns emerge for each sex. Accidents to young women tend to be in the kitchen

and involve the stove, while those to young men tend to involve flammable liquids used outside the home. Risk-taking behavior accounts for a significant number of burn accidents to adolescent males (driving too fast, playing with gasoline and gunpowder, climbing near high-tension electrical lines).

- The misuse of sunlamps is an age- and lifestyle-related problem that accounts for a disproportionate number of radiation burns among adolescents.

- Burn injuries can occur in situations in which hazards have been recognized, and the adolescent has ignored precautions suggested by a parent or other adult.

The educational diagnosis indicated certain characteristics about adolescents' knowledge about fire and burns:

- Overall scores and subscores related to type of knowledge, burn and product were all extremely low on diagnostic tests.

- Adolescents were generally unaware of the causes and consequences of burn injury, and knew few of the underlying facts and concepts. They scored somewhat better on preventive behaviors and those that minimized harm. But reports of the actual actions taken, for example, by victims whose clothing had ignited seem to indicate that in spite of knowledge, adolescents do not practice such behaviors in the emergency.

- In relating burn incidence to knowledge, the greatest need for knowledge is in the area of scald and flame burns, particularly in conjunction with ovens and ranges, flammable liquids, and flammable fabrics.

Scalds

For instance, when questioned about their knowledge of scalds occurring in the kitchen, adolescents were unable to:

- Explain why items in the environment may cause scalds.

- Recognize correct placement of cooking pots on a burner to prevent burns.

- Explain that placing a container of hot liquid on a tablecloth may result in a scald to a young child who may pull on the tablecloth.

- Explain that drinking a hot beverage while holding an infant in the lap may result in a scald to either the adolescent or the infant.

Flame

Asked about flame burns and their corresponding products, adolescents were unable to identify many common hazards.

Flammable Fabrics

With regard to flammable fabrics, adolescents were unable to:

- Recognize the increased potential of burn severity when flammable fabrics are involved.
- Identify the relative burning speed of common fabrics, recognize how quickly cotton clothing will burn, or select fabrics and styles of clothing that are not flame resistant but relatively fireproof.
- Define what is meant by flame-resistant fabrics and recognize current federal regulations of fabric flammability.
- Recognize correct maintenance of flame-resistant fabrics and explain what causes loss of flame resistancy in improper washing of fabrics.

Flammable Liquids

Concerning flammable liquids, they did not:

- Recognize the properties of flammable liquids (such as that gas vapors are heavier than air).
- Identify the relationship between flammable vapor and ignition source in an explosion.
- Identify storage of pressurized cans near heat as a potential cause of burns.
- Identify the correct procedures for using flammable liquids with power equipment.

Stoves

Asked about hazards connected with stoves, adolescents were unable to:

- Recognize the risk involved in having controls on either the front or the back of the stove.

- Recognize that tight-fitting, short-sleeved clothing should be worn while using stove.

- Explain risks associated with storing food above the stove.

A majority of the adolescents tested had previously received fire/burn safety information, mainly from parents and scouting. Although less than a third reported receiving fire/burn safety information from television or radio, almost all the adolescents watch television or listen to the radio every night of the week after 8 PM.

The educational diagnosis indicates that, for this sample, overall knowledge about burns is significantly related to school district, but not to sex, burn history, socioeconomic status or previous burn information. This suggests a general need for knowledge, but also that the area for intervention should be carefully selected with close consideration of the relevant findings.

Burn Injuries Occurring to Adolescents 13 to 19 Years of Age

State Burn Incidence Data

What do the data from the Massachusetts Reporting System indicate about burn incidence among adolescents, aged 13 to 19 years?

Approximately 95 cases (15.5%) of the state's reported burn population was between 13 and 19 years of age. This age group accounts for 12.8% of the total population of Massachusetts. Of the 72 cases for which sex was noted, 43 (60%) were male, and 29 (40%) were female. The total Massachusetts population is evenly divided between males and females for this age group. Of these burn patients, 74% were treated and released, and 26% were hospitalized.

The distribution of injuries by type of burn is presented in the following chart.

	Scald	Flame	Contact	Chemical	Radiation	Electrical
N	39	27	13	6	7	3
%	41%	28%	14%	6%	7%	3%

Scald Burns = 41.1% (39 cases)

Although domestic hot water systems accounted for one case (2.6%), and kitchen/serving accidents constituted fifteen cases (38.5%), scalds in this group began to show more variety. Younger age groups tended to be scalded in either kitchen or bathroom (tub) accidents. But adolescents, who presumably have entered the job market, displayed several other varieties of scald in small quantities: two auto radiator accidents (5.1%), two Industrial Process accidents (5.1%), two (5.1%) asphalt/tar burns, one (2.6%) wax burn; two burns (5.1%) involving hot chemicals in work settings; and one burn (2.6%) from a household appliance. Twelve victims (30.8%) were scalded under unspecified circumstances.

Flame Burns = 28.4% (27 cases)

In nine cases, the victim was actively using a flammable substance other than stove gas. No other age group exceeds this percentage of flame burns involving the use of flammable substances.

Five (18.5%) flame burns involved the use of stoves; two (7.4%) involved the use of matches or lighters (one victim ignited her hair while using a cigarette lighter); two (7.4%) resulted from explosions. A candle, match play, and a house fire accounted for one accident each. Two victims (7.4%) were injured in transportation accidents, and one (3.7%) sustained a flame burn from an electric blanket. Three (11.1%) flame burns occurred under other or unspecified circumstances.

Clothing was ignited in twelve of the 27 incidents. Pants or shorts (four cases) and shirts or blouses (three cases) were ignited most frequently. Other items of clothing which caught fire were: sweater or sweatshirts (two cases), outer wear, pajamas, and nightgowns (one case each). The more frequent ignition sources were stoves (three cases), using flammable substances (two cases), and transportation fires (two cases).

Contact Burns = 13.7% (13 cases)

Three contact burns (23.1%) involved radiators or radiator piping. One victim (7.7%) was burned by the outside surface of a stove, three (23.1%) from indoor grills, one (7.7%) from a hot plate, one (7.7%) from a pan, two (15.4%) from irons, and two (15.4%) from being hit with hot metal (industrial accident).

Other Burns = 16% (16 cases)

Chemical burns accounted for six cases (6.3%); for males, battery acid was often involved. Six cases (6.3%) involved sunlamps. One flash burn occurred while welding. Electrical injuries made up the remaining three instances (3.2%):

one from climbing a utility pole (play); one from contacting a live wire during a fall from a tree; and one from an arc welder.

Burn Victim Profile Data

What Are the Characteristics of the Adolescent Burn Victims?

Ninety-six adolescents residing in the Boston SMSA were interviewed or involved in in-depth investigations for this profile study. The following table describes this population according to sex, race, household type, number in household, and type of residence.

DEMOGRAPHIC CHARACTERISTICS: ADOLESCENTS 13-19 YEARS

	N	% Total	% Respondents
Sex			
Male	43	44.8	44.8
Female	53	55.2	55.2
Race			
White	91	94.8	94.8
Black	4	4.2	4.2
Other	1	1.0	1.0
Household Type			
Both Parents/Children	59	61.5	70.2
Single Parent/Children	13	13.5	15.5
Unrelated Adults	5	5.2	6.0
Married	2	2.1	2.4
Alone	2	2.1	2.4
Other	3	3.1	3.6
No Answer	12	12.5	—
Number of Children in Household			
1	9	5.2	15.3
2-4	31	32.3	52.5
5-6	13	13.5	22.0
7 or more	6	6.3	10.2
No Answer	37	38.5	—
Residence			
Owned	45	46.9	59.2
Rented	31	32.3	40.8
No Answer	20	20.8	—

There were more females (55%) than males in this sample. The racial distribution (94.7% white, 5.2% other) corresponds almost exactly to the racial distribution in the Boston SMSA (94.5% white, 5.5% other). The majority of adolescents were living with both parents (76%) or a single parent (16%), although other living arrangements typical of young adults did appear: 6% were sharing an apartment with friends, 2% were married; and another 2% were living alone. Over half of these adolescents lived in houses owned by their families.

What Types of Burn Accident Happen to This Age Group?

The distribution of injuries in the profile data* is shown below:

			Other			
	Scald	Flame	Contact	Chemical	Radiation	Electrical
N	15	56	3	3	14	5
%	16%	58%	3%	3%	15%	5%

What Is the Relative Severity of the Burn Injuries in This Age Group?

The following table presents the data on measures of severity for this sample. Injuries are grouped under "scald," "flame," and "other."

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*The distribution by type of burn in this sample differs from the burn-type distribution in the state-reported burn incidence data. This sample reflects the interests and mandate of the agencies (BISU and CPSC) which conducted the investigations. A major focus of both agencies was flammable clothing, since federal legislators were considering the need for federal standards to regulate the flammability of clothing. Hence, the sample includes a disproportionate number of severe flame burns. However, the severity of these burn injuries (discussed below) provides justification for studying this kind of accident in depth.

BURN INJURY INVESTIGATION DATA:
MEDICAL FACTORS FOR ADOLESCENTS 13-19 YEARS

			% Respondents			
		N	All Burns	Scald	Flame	Other
Medical Treatment	N=	96		15	56	25
Treated and Released		63	66	73	53	88
Expired		2	2	—	2	4
Hospitalized		31	32	26	45	8
Length of Hospital Stay						
Not Hospitalized		63				
Hospitalized	N=	31		4	24	3
1-9 days		11	35	50	33	33
10-29 days		9	29	—	33	33
30-49 days		5	16	25	13	33
Over 50 days		6	19	25	21	—
Extent of Burns						
Total Body Surface Area Burned	N=	96		15	56	25
Less than 5%		46	48	33	39	76
5-19%		24	25	7	36	12
20-39%		4	4	—	7	—
More than 40%		22	23	60	18	12
Body Surface Area With Third Degree Burns:						
No Third Degree Burns		17				
With Third Degree Burns	N=	79		14	41	24
Less than 5%		72	91	86	70	96
5-19%		3	4	—	7	—
20-39%		1	1	7	—	—
More than 40%		3	4	7	23	4
Body Area Injured						
Was Face Involved?	N=	96		15	56	25
No		49	51	60	54	40
Yes		47	49	40	46	60
Were Hands Involved?	N=	96		15	56	25
No		58	60	60	59	64
Yes		38	40	40	41	36
Were Genitalia Involved?	N=	95		15	55	25
No		93	98	100	98	96
Yes		2	2	—	2	4
Not Ascertained		1				

For the entire sample, about two-thirds of the patients could be treated in the emergency room and released; about one-third were hospitalized, and 2% expired after admission to the hospital. Almost half (45%) of flame burn patients required hospitalization, compared to only 26% of the scald burns and 12% of the other burns. Of the 31 patients who were hospitalized, 24 were burned by flame; of the flame burn victims, 66% were hospitalized for less than a month, while 21% were hospitalized for longer than fifty days.

Thirty-nine percent of flame burns covered less than 5% BSA, while 76% of the other burns and 33% of the scald burns were in this category. Accounting for burns covering over 40% BSA were 18% of the flame burns, 60% of the scalds, and 12% of the other burns.

The sample is almost equally divided between accidents that did and did not involve the face. However, the "other" category, which includes radiation burns from sunlamps, has a high percentage (60%) of face involvement, whereas less than half of the flame (46%) and scald (40%) burns involve the face. Hands were involved in about 40% of all types of injury. Few injuries involved the genitalia.

When, Why, and How Do Injuries Occur?

Scald Burns

These accidents can be grouped in general categories according to type of victim activity.

- 7 while preparing, serving, or drinking coffee, tea, or hot water
- 4 while using cooking grease/oil
- 2 by hot water in car radiator
- 2 in other activities

In this sample, the burns clustered in the fall months (40%), with spring being the season of least scalds (7%). Weekday, weekend distinctions do not seem significant. Sixty percent of the accidents happened between 3 and 9 P.M.

The majority of these accidents (73%) happened in the kitchen of the victim's own residence. The others occurred in the street, an unusual place for a scald; most of these were related to automotive transportation, as the sketches below indicate. No teenager was scalded by hot tap water in the bathroom sink or tub. There was no noted disability related to the injuries. Eighty percent resulted from the victim's own activity.

Project staff interviewed six of these patients; their accidents are described below:

> A 13-year-old female was burned with hot oil when she stood up quickly and bumped into fondue pot which her mother was carrying. (Hospitalized 2 days.)
>
> A 16-year-old female was burned with hot bacon grease when the clay container she was holding "exploded," spilling the grease. (Not hospitalized.)
>
> A 17-year-old male was scalded when the new car he was driving flipped over while going 110 mph; the boy was pinned under the car, the car radiator spilled hot water on him. (Hospitalized 100 days.)
>
> A 19-year-old female was scalded at work when she bumped into another waitress carrying hot coffee. (Not hospitalized.)
>
> A 19-year-old male was scalded while attempting to screw on the cap of a hot car radiator. (Not hospitalized.)
>
> A 19-year-old male slipped and coated self with hot tar while assisting a truck driver during a highway accident. (Hospitalized 34 days.)

These accidents illustrate the range of severity of scald injuries (from emergency room treatment to prolonged hospitalization). The variety of behavior (working, risk-taking, helping, etc.) and variety of scalding substances (oil, bacon grease, water, coffee, tar) indicate that a broad range of hazards and precautions must be considered when planning an educational campaign for this age group.

Flame Burns

The following indicates the distribution of injuries by type of victim activity:

- 21 while using flammable or volatile substance
- 17 while lighting or starting a fire
- 10 while near, but not actively using, an ignition source
- 6 while actively using or working with an ignition source
- 1 while playing with matches

- 1 in other activities involving flame

The timing of flame burn accidents is similar to that of scalds. Most accidents (35%) occurred in the fall, with summer accounting for 28%, winter 22%, and spring only 16%. Accidents were distributed rather evenly throughout the seven days. Nearly half of the accidents (48%) occurred between 3 and 9 PM. The time spanned by school hours (9 AM to 3 PM) accounted for 24% of the injuries; but school is noted as the location of accident in only 2% of the injuries, which suggests that the majority of the injuries between 9 AM and 3 PM happened during weekends or school holidays. Eighteen percent of the accidents occurred between 9 PM and 6 AM and 11% occurred between 6 and 9 AM.

The victim's own residence was the site of 71% of the flame burn injuries. When combined with the 11% of the accidents at a friend's or relative's home, the residential location accounts for over 80% of the accidents. Teenagers were most frequently burned in the kitchen (46%), and the stove was the ignition source in all 26 kitchen accidents. Half of these accidents occurred when the victim tried to light a gas oven or burner without taking proper precautions (e.g., turning off jet and letting gas dissipate before lighting second match). Only 15% of the injuries occurred in rooms other than the kitchen. The yard and the garage, two locations often associated with flammable liquids (primarily gasoline), were the sites of 18% of the flame burn accidents. An additional 21% occurred in other outdoor locations.

It seems that most of these accidents (93%) occurred as the result of the victim's own activity or in combination with another person's activity. Only 8% of the victims could be considered innocent bystanders, half of whom were victims of house fires.

Clothing ignition occurred in 55% of the cases. Day and outer wear were involved four times more frequently than sleepwear. In 18% of the cases, the first article to ignite was the shirt or blouse. Pants were first to ignite in 14% of the accidents.

Flammable liquids were involved in 75% of the flame burn injuries, with gasoline (23%) and natural gas (21%) accounting for over 40% of the accidents. Other substances included turpentine, cigarette lighter fluid, and cooking oil.

In 39 cases, the victim's first response to the emergency was recorded. Running was mentioned by almost half of the patients; screaming was the other first response mentioned most often. Neither of these responses is the most effective first response, although screaming is an almost automatic response and does draw assistance. The most appropriate responses--drop and roll, remove clothing, extinguish flames with water--were mentioned in very few cases. However, in half of the cases where the bystanders' responses are noted someone knew to drop the victim to the ground or roll him in a blanket.

Eight patients were interviewed by the project staff; brief sketches of their accidents follow.

> A 13-year-old female ignited her hair on stove's gas burner she was lighting with cigarette lighter; shirt ignited; alone in kitchen. (Hospitalized 17 days.)
>
> A 13-year-old male was emptying a tank of motorbike fuel into a shallow pan when a neighbor lit a cigarette and tossed a match near the pan; neighbor's pant-leg ignited; victim tripped over flaming pan in attempt to help friend. (Died after 1 day in hospital.)
>
> A 13-year-old male was a participant in an initiation rite at scout camp; he was tied to a tree, doused with gasoline (mistaken for water?), and ignited; scoutmaster and other scouts were present. (Hospitalized 29 days.)
>
> A 14-year-old female leaned against stove for warmth while heating water for tea; ignited nightgown; her grandfather was present. (Hospitalized 10 days.)
>
> A 14-year-old male was making a house call with father to repair oil heater when a leaking gas main caused explosion and house fire; father and son were burned. (Hospitalized 14 days.)
>
> An 18-year-old male was burned in an automobile accident when gas tank exploded; he was upset about breaking up with his girlfriend, and was driving too fast. (Hospitalized 37 days.)
>
> An 18-year-old female (retarded) was playing with matches and ignited her sock and pant-leg; she panicked and ran. (Hospitalized 90 days.)
>
> A 19-year-old male's clothing was ignited by a flash flame caused by too much starter liquid being poured on barbecue grill. (Hospitalized 3 days.)

The interviews revealed that patients responded to clothing ignition in panic. Only one patient (the driver of the car) acknowledged that he dropped and rolled to extinguish the flames. He assumed that "everybody knows that--you see it all the time on TV." Yet, of the other six victims whose clothing ignited, four ran varying distances before other people caught them and extinguished their flames. The boy who was tied to a tree was unable to help himself.

In at least three cases the activity that produced the accident had been the subject of safety discussion prior to the accident. The girl whose hair ignited had waist-length hair. This was a concern to her mother, who had recommended that the girl tie her hair back before using the stove. The father of the boy who was burned while emptying gas from the motorbike was a "high explosive welder." The father had spoken to his son of the necessity of draining the gas before storing the bike indoors, and had provided the proper container for the task; this container was not being used at time of accident. The retarded girl had been caught playing with matches some years before and told of the danger. All effort was made by the family to keep matches out of sight. This information is of great importance to educators designing a burn safety campaign: The critical factor to determine the effectiveness of an educational campaign is not what a person knows or recognizes, but how a person behaves.

Other Types of Burns

The distribution by type of burn is as follows:

- 3 contact burns
- 3 chemical burns
- 14 radiation burns
- 5 electrical burns

Most of these burns occurred during spring and summer, and over half occurred on weekends. Over half of these accidents happened between 3 and 9 P.M.

The difference in time distribution from scalds and flame burns seems to be due to the overrepresentation of radiation burns (56%). These were caused primarily from overexposure to sunlamps, which are generally used during leisure time. Injuries tend to occur when people fail to follow instructions for use of the sunlamp. The highest percentage of sunlamp accidents (40%) occurred in the spring (the lowest season for scalds and flames), when these adolescents were attempting to get a head start on a tan.

Again, the victim's residence was the most frequent site of the burn (72%). The number of sunlamp accidents made the bedroom the most frequent location of accidents (43%). The kitchen (19%) and the garage/yard (15%) were the other locations. The overwhelming majority of accidents (96%) resulted from the victim's own activity. In only one case did a prior disability influence the accident.

Two adolescents and the mother of a third were interviewed by project staff.

> A 15-year-old male was burned while hitching a ride on a freight train; contacted a dangling high tension wire, igniting clothing and causing deep electrical burns. (Died after 23 days in hospital.)
>
> A 14-year-old male was burned in school shop when fellow student left a torch at an improper angle; minor heat burn to neck. (Not hospitalized.)
>
> A 17-year-old female, a waitress at McDonald's, slipped while hurrying and fell; put out arm to catch herself and contacted hot grill. (Not hospitalized.)

The interviews indicated that some safety discussions had occurred prior to these accidents. The school shop accident happened when a fellow student failed to observe proper safety procedures; the victim himself was behaving properly. It must be assumed that the hazards of burn injuries at a fast-food restaurant are the subject of employee orientation; the waitress in this accident had burned herself previously on a deep-fat basket for french fries. The mother whose son died said that her son's exuberance and dare-devil behavior had been a constant concern to her, but that she was uncertain if her son had any idea of the hazards of electrical power lines.

Risk-taking behavior accounts for a significant number of burn accidents to males in this age group. Of the eight male burn victims interviewed in this sample, at least four were injured as a result of risk-taking behavior: hitching a ride on a freight train, driving too fast, deliberately playing with fire. A fifth accident involving the flicking of a match near or into a pan of gasoline might also be placed in this category.

All of the flame burns to males involved flammable liquids: gasoline in an automobile accident, in an accident involving draining a motorcycle, and in an initiation rite at scout camp; a gas main explosion; and charcoal starter fluid. All but one of these accidents occurred outdoors, and cannot be attributed to vapor buildup in a poorly ventilated, enclosed area.

The kitchen stove was involved in most burns to females in this interview sample. Four of the six females interviewed sustained injury in a kitchen: two suffered clothing ignition at the stove, two were burned by hot oil or grease. A fifth case involved a cooking grill at work.

Educational Diagnosis: Adolescents—Grades Eight and Eleven

Characteristics of the Adolescent Sample

The adolescent sample completing the criterion-referenced test consisted of 412 eighth- and eleventh-grade students, ages 12 to 18, from five school districts in the Boston SMSA (experimental site). The following table describes the total sample as well as the 50% subsample (students for whom both the open-ended and multiple-response questions were coded). The characteristics examined were: sex, grade, race, socioeconomic status, family size, burn history, sources of burn, fire safety information, and media habits.

DEMOGRAPHIC CHARACTERISTICS

	Total Experimental Sample (N=412)			50% Experimental Subsample (N=208)		
	N	% Total	% Respondents	N	% Total	% Respondents
Sex						
Male	207	50.2	51.2	107	51.4	52.7
Female	197	47.8	48.8	96	46.2	47.3
No Answer	8	1.9	—	5	2.4	—
Grade						
8	203	49.3	49.3	102	49.0	49.0
10	7	1.7	1.7	3	1.4	1.4
11	202	49.0	49.0	103	49.5	49.5
Race						
Black	2	0.5	0.5	0	—	—
White	363	88.1	90.5	185	88.9	92.5
Amer. Ind.	1	0.2	0.2	1	0.5	0.5
Spanish	4	1.0	1.0	0	—	—
Oriental	4	1.0	1.0	1	0.5	0.5
Other	27	6.6	6.7	13	6.3	6.5
No Answer	11	2.7	—	8	3.8	—
Socioeconomic Status						
High	41	10.0	12.1	23	11.1	13.7
	57	13.8	16.9	36	17.3	21.4
Middle	113	27.4	33.4	49	23.6	29.2
	106	25.7	31.4	50	24.0	29.8
Low	21	5.1	6.2	10	4.8	6.0
No Answer	74	17.9	—	40	19.3	—
Number in Household						
1-4	118	28.6	30.1	55	26.4	27.6
5-6	173	42.0	44.1	90	43.3	45.2
7 or more	101	24.5	25.8	54	26.0	27.1
No Answer	20	4.9	—	9	4.3	—

The 50% subsample was similar to the total sample in terms of characteristics and experiences. Boys and girls were represented equally, as were eighth and eleventh graders. The vast majority of students in the subsample were white (93%), with the remaining students representing other minority populations but including no blacks.

Socioeconomic status (SES) of the 50% subsample was determined by using Hollingshead's five-point scale, which is based on parent's occupation and education. ("One" is the highest rank, generally indicating that parents are professionals with graduate education; "5" indicates that parents are semi-skilled or unskilled workers who have not completed high school.) Using this classification, the SES of the families of eighth and eleventh graders divided roughly into thirds: 35% fell in the two highest groups, 29% in the middle group, and 36% in the two lowest SES groups.

In terms of family size, nearly half of the adolescents (45%) came from families with five or six members, while the remaining half were equally divided between households with one to four persons (28%) and seven or more persons (27%).

In terms of burn history, the following table shows that over half of the students (55%) reported that they had experienced burns at some time in their lives. Of these, 49% had received mild burns, and 6% received burns severe enough to require treatment by a physician. Most had incurred contact burns (97%) or scald burns (77%). About half had experienced either flame burns (48%) or burns from electrical sources (45%); only 6% had been burned by flammable liquids.

DEMOGRAPHIC CHARACTERISTICS

	Total Experimental Sample (N=412)			50% Experimental Subsample (N=208)		
	N	% Total	% Respondents	N	% Total	% Respondents
Burn History						
No Answer	28	6.8	—	17	8.2	—
Never Burned	170	41.3	44.3	86	41.3	45.0
Mildly Burned	193	46.8	50.3	93	44.7	48.7
Severely Burned	21	5.1	5.5	12	5.8	6.3
Type of Burn						
Contact	207	50.2	96.7*	102	49.0	97.1*
Hot Liquid	162	39.3	75.7	81	38.9	77.1
Electrical	100	24.3	47.2	47	22.6	44.7
Flame	93	22.6	43.5	52	25.0	47.6
Flammable Liquid	17	4.1	7.9	6	2.9	5.7
Other	37	9.0	17.3	21	10.1	20.0
Don't Know	10	2.4	4.7	6	2.9	5.7
Fire Safety Information						
No Answer	12	2.9	—	9	4.3	—
No	138	33.5	34.4	67	32.2	33.7
Yes	262	63.6	65.5	132	63.5	66.3
Parents	111	26.9	42.4**	62	29.8	47.0**
Scouting	112	27.2	42.7	59	28.4	44.7
Fire Dept.	82	19.9	31.3	40	19.2	30.3
Teacher	75	18.2	29.6	39	18.8	29.5
TV	65	15.8	25.0	38	18.3	28.8
Movies	25	6.1	10.0	11	5.3	8.3
Literature	21	5.1	8.0	9	4.3	6.8
Work	7	1.7	2.7	6	2.9	4.5
Military	2	0.5	0.8	2	1.0	1.5
Other	33	8.0	12.6	13	6.3	9.8

* % of persons who had been severely or mildly burned (N=214, 105).

** % of persons who had received fire or burn safety information (N=262, 132).

About two-thirds (66%) of the students reported they had previously received fire or burn safety information. The sources mentioned most frequently were parents (47%) and scouting (45%). Less frequent sources were the fire department (30%), teachers (30%), and television (29%). No other source was mentioned by more than 10% of the students.

Media Habits

Adolescents spend a great deal of time watching television and listening to the radio. Almost 75% watch television every day of the week. The most popular time for watching TV is after 8 PM. Fifty-four percent say they watch between 8 and 11 PM and 24% report watching after 11 PM. Almost half of the students (48%) listen to the radio after 8 PM; just over a quarter (28%) listen between 2 and 4 PM.

Nature and Extent of Knowledge

Total Scores on the Criterion-Referenced Test

The distribution of scores for the total adolescent sample is presented on the following page. Out of a possible score of 136, scores were very low, ranging from 0 to 74. The mean score for the 50% subsample was 43.4 with a standard deviation of 14.5. A comparison of the mean scores of eighth- and eleventh-grade students revealed no significant differences; in fact, they were almost identical, as the following table indicates.

Grade	Total N	Mean	Standard Deviation
8	102	43.5	14.1
11	103	43.5	14.8
Combined	208**	43.4	14.5

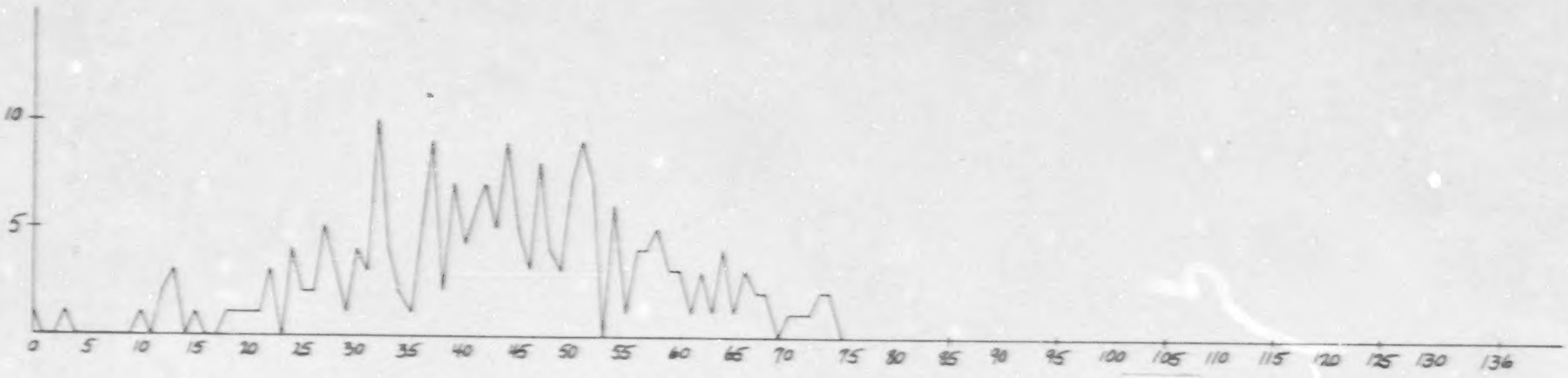
*A t test on raw scores resulted in failure to reject the H^0 at $\alpha = .05$.

**Includes three tenth-grade students.

Boston - Grades 8 and 11 - 1976

Total Test Scores

N = 208



An examination of recoded scores illustrates small, though not significant, differences between grades:

Grade	Total N	Low (0-36)	Low Average (37-43)	High Average (44-50)	High (51 & over)
8	102	25.5%	22.5%	22.5%	29.4%
11	103	34.0%	15.5%	15.5%	35.0%
Combined	208**	29.8%	19.2%	18.8%	32.2%

*A chi-square on raw scores resulted in failure to reject the H^o at $\alpha = .05$.

**Includes three tenth-grade students.

Domains and Related Subscores

Overall, compared to other samples, the average percent correct for any given subscore is much lower for this group. The highest ranking subscore never exceeds an average percent correct of 56%, which suggests many knowledge gaps.

DOMAINS AND RELATED SUBSCORES

	Total Possible Score	Average % Correct		
		All Adolescents	Grade 8	Grade 11
ALL ITEMS	136	32	32	32
Type of Knowledge				
Behaviors to Minimize Harm	9	42	44	40
Preventive Behaviors	37	42	43	42
General Awareness	45	34	34	35
Facts and Concepts*	47	28	26	29
Type of Burn				
Smoke	6	43	44	42
Scald*	11	37	33	41
Flame	66	32	32	33
Chemical	3	28	25	31
Electrical	30	26	26	26
Type of Product				
Matches/Smoking Materials	3	56	57	55
House Fires	4	47	50	43
Ovens/Ranges	5	33	31	34
Flammable Liquids	29	31	31	31
Space Heaters	9	31	33	30
Flammable Fabrics	30	30	31	30
Electrical Sources	14	24	24	25

*A t test on the raw scores resulted in rejection of the H^{o} at level α = .05.

Within the type of knowledge domain, adolescents did best on information about preventive behaviors and on behaviors to minimize harm once a burn or fire had occurred (each having an average percent correct of 42%). Awareness of causes and consequences ranked third (34%), while knowledge about underlying facts and concepts was the lowest (28%). In this last respect the adolescents' scores were similar to those of the younger age groups.

An analysis of subscores related to type of burn reveals that adolescents ranked highest on knowledge related to smoke (43%), followed by scalds (37%) and flame burns (32%). Knowledge related to chemical and electrical burns ranked lowest (28% and 26%, respectively).

In the type of product domain, knowledge regarding matches and smoking materials ranked highest (56%) with house fires ranking second highest (47%). Adolescents exhibited less knowledge about ovens/ranges, flammable liquids, space heaters, and flammable fabrics (33%, 31%, 31%, 30%, respectively). The lowest subscores were related to electrical sources (24%).

A comparison of subscores for grades 8 and 11 revealed only two significant differences between them: eleventh graders did significantly better on items related to facts and concepts within the type of knowledge domain and on items related to contact burns within the type of burn domain.

Individual Items

The average percent correct was very low for most items: less than 45%. For the most part differences between grades for individual items averaged about 6 to 7%, with more eighth than eleventh graders answering questions correctly. This finding is surprising, but might be attributed to the fact that 74% of the eighth graders said they had previously learned about fire or burn safety, compared with only 55% of the eleventh graders. The differences between grades are relatively small, however, so individual items for grades 8 and 11 are combined and discussed together.

Using the same criteria employed for other sample groups (over 85% correct = high; 65 to 85% = medium; less than 65% correct = low), results for all but one item fall in the low category. Since the purpose of the educational diagnosis was to establish priorities, new criteria were established for the adolescent group in order to define the topic areas in greatest need of attention through educational intervention. The new criteria are:

% Correct	Category
Over 65	High
45-65	Medium
Less than 45	Low

Based on these new criteria, a large percentage of the items still fall in the low category (67%) with 4% ranking high, and 29% falling in the middle. An examination of items in the lowest category revealed that adolescents were unaware of the potential dangers to them. They did not recognize the odds of being in a serious fire, or know that severe burn injuries often require long-term recovery. Similarly, they were unaware that high tension wires and misuse of fuses can cause burns or fires. Their lack of knowledge about electricity included ignorance about factors that can affect human resistance to the passage of electrical current. The meaning of flame resistant was also unclear to adolescents. They could not identify the correct procedures for washing flame-resistant fabrics or the proper clothing to wear if flame-resistant garments are not available.

The properties of gasoline and the disadvantages of storing gasoline were answered poorly, but students did moderately well in recognizing the results of pouring charcoal starter on a lighted barbecue and in selecting correct containers for storing gasoline and oily rags. They also did moderately well in identifying risks associated with storing matches; in recognizing common caustic substances; and recognizing current government legislation with regard to flame resistancy standards in some consumer products. To minimize harm, students knew moderately well how to handle a grease fire, treat a scald, and move through smoke.

The items that most students answered successfully dealt with identifying common flammable liquids, knowing the appropriate behavior if a flammable liquid is spilled on clothing, and knowing the drop-and-roll technique to extinguish burning clothes.

Facts and Concepts

As noted, knowledge of facts and concepts ranked lowest among the four knowledge domains. The following focuses on students' deficiencies and misconceptions with respect to basic principles of electricity, flammable fabrics, flammable liquids, and causes of scalds.

TYPE OF KNOWLEDGE—FACTS AND CONCEPTS

Question Number	Objectives	Type of Burn	Type of Product
HIGH 23	Identify some common flammable substances.	Flame	Flammable Liquid
63	Recognize properties of a flammable liquid (gas vapors travel).	Flame	Flammable Liquid
MEDIUM 32	Deduce cause-effect principles of combustion.	Flame	Ovens/Ranges
57(69) (70)	Recognize current federal regulations about flame and smolder resistance in consumer products (baby's sleepwear, baby's mattress).	Flame	Flammable Fabric
35(24) (25)	Recognize possible causes of electrical shock or burns from electrical appliance cords (live electricity; water conducts).	Electrical	Electrical Sources/ Appliance Cord
24	Identify some common caustic substances.	Caustic	
LOW 30a 28	Given a situation, deduce the relationship between flammable vapor and ignition source in an explosion.	Flame	Flammable Liquid
47	Recognize properties of flammable liquid (gas vapors heavier than air).	Flame	Flammable Liquid
45	Identify definition of flame-resistant fabrics.	Flame	Flammable Fabric
57(71)	Recognize current federal regulations of flame and smolder resistancy standards in consumer products (wall-to-wall carpet).	Flame	Flammable Fabric
40	Identify relative burning speed of common fabrics.	Flame	Flammable Fabric
39	Recognize correct maintenance of flame-resistant fabrics.	Flame	Flammable Fabric
41	Distinguish cause of loss of flame resistancy due to improper washing of flame-resistance fabrics.	Flame	Flammable Fabric
14(52) (53) (54) (55)	Recognize factors operating in human resistance to passage of electrical current (part of body contacted, dryness of skin, air temperature and humidity).	Electrical	Electrical Sources/ Appliance Cord
17	Recognize that electrocution is a function of grounding.	Electrical	
19	Acquire knowledge that overhead transmission lines are a risk as they are never insulated.	Electrical	
16a	Given a situation, explain the cause of electrical burn as arcing from a high voltage wire.	Electrical	
35(26) (27)	Recognize causes of possible electrical shock or burns from electrical appliance cords (grounding).	Electrical	Electrical Sources/ Appliance Cord
50	Recognize function of fuses in preventing electrical fires.	Electrical	Electrical Sources
52	Identify correct amperage of most common household fuses.	Electrical	Electrical Sources

Many of the low items dealt with electricity. Of all the following factors that can affect human resistance to the passage of electrical current, "the part of the body contacted" was recognized as important by only 28% of the students; "the dryness of the skin" by 23%; the "air temperature" by 9%; and "humidity in the air" by 18%. In conjunction with the principle of grounding, only 31% said that a bird can sit on a high voltage electrical line because "the bird does not ground the electricity." Almost another third cited the reason that "all wires are insulated" (which they aren't), and 24% checked "don't know." In response to the question, "When are overhead transmission lines for high voltage electricity (over 4,000 volts) insulated?" only 6% correctly answered never. Half said "don't know," while less than 15% each checked areas zoned for industry, within city limits, and areas zoned for private housing (all incorrect). Since high tension wires are a particular risk to adolescents, often resulting in very severe injuries or death, we presented the following hypothetical situation to determine students' understanding of electrical arcing and grounding.

> On a Sunday afternoon, Bobby and Jimmy were hanging around with nothing to do. Bobby decided to climb a utility pole. He went up half-way and came down safely. Then Jimmy tried for the top. Just before reaching the top, without touching the wire (but still holding on to the pole), Jimmy saw a ball of fire and fell from the pole.
>
> Why do you think there was a ball of fire causing Jimmy to fall to the ground, even though he didn't touch the wire?

Half of the sample answered this open-ended question, attempting to explain why the injury happened; the other half did not respond. Eighty-six percent earned no points for the question, placing this item in the low group.

Of those who did respond, about 10% stated very generally that electricity running through the wires caused the ball of fire.

> Because of electrical current through the *unsafe* wire.
>
> Because the wire was live.
>
> Because of the high voltage.
>
> Electricity passing through the wires or transformer box.

Another 9% said incorrectly that the ball of fire resulted from a short circuit or faulty wire. About 10% of the students mistakenly wrote that the boy probably fell because he was frightened or that his weight on the pole caused it to shake.

> It scared him; he was afraid to get burned so he moved quickly and fell.
>
> His movement caused a short circuit.
>
> It scared him.
>
> He probably shook the pole causing worn wires or loose connections to create a short circuit.
>
> It frightened him into letting go.

Less than 15% referred correctly to the principle of arcing or said that electricity could have been grounded through the pole.

> The pole conducted the electricity.
>
> His body picked up electrical currents.
>
> An electrical shock could have gone through the pole.
>
> Electrical currents can jump more than a foot.

Another situation was described as follows:

> Mrs. Smith was hurrying to make a pot of morning coffee. She plugged one end of the electric cord into the wall receptacle, filled the pot with water and went to plug the female end of the appliance cord into the pot.

Students were asked to complete the sentence, "Mrs. Smith is risking an electrical shock or burn because __________." A moderate number of students checked that the female end of a plugged-in cord carries live electricity (57%) and that a cause of a shock or burn would be wet hands (64%). Many, however, did not realize that the electricity can easily ground itself through the body (36%).

When asked if it would be "O.K. to use any size fuse," 13% said if "the electrical size of the fuse does not exceed the recommended size by five units"--an action highly likely to result in a fire. When asked the electrical ratings of fuses for common house circuits, 43% checked "don't know." Only 23% correctly answered, "15 to 20 amps."

Another major area in the low category was flammable fabrics. Fifty-six percent of the students incorrectly said that flame resistant means a garment will "not catch fire." Only 18% knew that flame resistant means a material will "stop burning when the flame is removed." Only 16% could identify a label with proper laundering instructions for flame-resistant fabrics. Another 49% said a flame-resistant fabric would be most likely to lose its flame resistancy if it were washed in a "harsh phosphate detergent." In fact, a phosphate detergent is the appropriate kind of cleanser to use. Soap leaves a film of flammable fatty residue which coats the surface of a flame-retardant garment rendering the treatment ineffective.

Less than one-third of the students could rank the relative speed (from fastest to slowest) with which the following fabrics (of equal size and weight) would burn (cotton, nylon, wool, fiberglass). Although most students knew that current federal standards for flame and smolder resistancy exist for consumer products such as babies' sleepwear and mattresses only 17% knew that wall-to-wall carpeting is also required to be flame resistant.

The final item in the low category involved recognizing the properties of gasoline. Only 18% knew that such vapors are "heavier than air and gather in low places." Approximately one-third said that "gasoline vapors are lighter than air and rise to the ceiling," and another third answered "don't know."

Similarly, responses to the open-ended question given below clearly indicate that students did *not* understand the relationship between flammable vapors and an ignition source.

> Caroline was using gasoline to remove tar which her husband had tracked in on the basement floor. When the gas water heater came on (10 feet away from her on the other side of the room), the room burst into flames.

Students were asked, "What probably caused the gasoline to ignite?" Eighty percent of the sample answered the question, but only 6% stated that it is the presence of *both* the pilot light flame and the vapors which caused the room to burst into flames. Thirteen percent said that the vapors alone were the cause of ignition. At least a third said the fire resulted from the general heat in the room, and made no reference to the vapors. Other students apparently believed that the heat or flame must come in direct contact with the liquid gas for ignition to occur; they did not realize that vapors can travel across the room.

Some representative responses were:

> The gas fumes and the pilot light.
>
> The fumes probably caused the room to burst into flames.
>
> The heat probably got so hot that the room burst into flames or chemicals in the tar and gasoline.
>
> It ignited because she was too close to the water heater.

Similarly, responses to a question involving a kitchen scene were analyzed, and we discovered that less than 45% of the students correctly explained that an aerosol can near the flame of a gas stove presents a hazard because the can can burst into flames or explode.

Items involving identification of some common caustic substances (bleach, drain opener, dishwasher detergent, window cleaner) and the elements of combustion fell in the medium category. Slightly more than half of the students (55%) chose the correct relationship between oxygen and fire, specifically, "If a grease fire broke out in your oven and you closed the door it would control the fire by reducing the oxygen." At least 23% said closing the oven door would "spread the fire by increasing the pressure," an erroneous conclusion.

Students were most successful in identifying some flammable substances (airplane glue, charcoal starter, nail polish remover, and lighter fluid). As noted, students did not know that gas vapors are heavier than air and gather in low places. When given a choice about the properties of gas, however, most students chose that storing gasoline in a can without a top will cause vapors to leak into the room, which can be ignited by a distant flame. It is possible that students do know that gas vapors will leak from a container, but not necessarily that they gather near the floor and can be ignited by a flame from across the room.

General Awareness

General awareness items ranked third overall, with a fairly low average of 34% of the students giving correct answers. None of the items within this category were answered correctly by more than 65% of the eighth- and eleventh-grade students. Objectives in need of attention (the low category on the table on the following page) include awareness of one's general vulnerability to a fire or burn injury and, more specifically, of the causes and consequences of injuries associated with fabric ignition, scalds, and electricity (high tension wires, fuses, space heaters).

At the most general level of awareness, less than 25% recognized that their "chances of being in a fire serious enough to call the fire department" were more than one in ten. Another quarter checked one in 100, while 36% checked "don't know." When asked to write the phone number of their local fire department, only 18% of the students were able to provide one.

Most eighth and eleventh graders were unaware of the extent of treatment required for a severe burn (third-degree burn over half the body, including face and hands), or the amount of hospitalization. Only 13% realized that a child burned over half of his body at age 7 will have to undergo periodic treatment, returning to the hospital for reconstructive surgery until age 18. Over half (53%) thought he would finish by age 14 or before (age 10, 14%; age 12, 23%; age 14, 16%); another third (32%) did not know. Just over one-third (38%) correctly recognized the approximate period of hospitalization (33 weeks) for the two years immediately after the burn. More students chose a much shorter period (four weeks, 5%; eight weeks, 23%) than a much longer period (seventy weeks, 20%). Few students said that scars from such an injury would be "hardly noticeable" (3%) or would "fade by the time he is 10 or 11" (4%). However, as many students incorrectly checked that the scars can "be mostly eliminated by plastic surgery" (37%) as (correctly) realized that the child would be deformed permanently (38%).

Students' knowledge of the disastrous results of high tension wire injuries also fell into the low group. As noted, very few students understood the basic principles of electrical arcing or grounding. Similarly, when asked for the "two most likely results" of an accident involving high tension wires, only 24% correctly checked "severe scars" and only 9% correctly checked "loss of arms or legs." Students were much more likely to say that the individual would suffer a minor shock (50%) and a "back injury from the fall" (67%). In other words, a majority of the students quite incorrectly perceived that the consequences of the fall were worse than the consequences of the electricity.

Students also scored low on items involving the function of fuses and the risks of space heaters and extension cords. Fifty-nine percent of the students correctly selected fuses

TYPE OF KNOWLEDGE—GENERAL AWARENESS

Question Number	Objectives	Type of Burn	Type of Product
HIGH			
—	—	—	—
MEDIUM			
29	Identify burn risks associated with storage of matches above stove.	Flame	Matches/Smoking Materials
59	Predict results of pouring a flammable liquid on an ignition source.	Flame	Flammable Liquid
53	Recognize common household devices for preventing electrical fires or burns.	Electrical	Electrical Source
25(74)	Given a situation, deduce the cause of death from smoke inhalation as a result of bringing a charcoal grill into a closed unvented area.	Smoke	
64(24)	Deduce the cause of death from using gas space heaters in closed, unvented areas (carbon monoxide poisoning).		Space Heaters
LOW			
13	Recognize their chances of being in a fire serious enough to call the fire department.	Flame	
4	Recall the phone number of their local fire department by memory.		
42	Acquire knowledge of the swiftness with which common cotton clothing will burn.	Flame	Flammable Fabric
44	Acquire knowledge of increased burn severity when flammable fabrics are involved.	Flame	Flammable Fabric
55	Given a living room scene, identify fabric ignition as a risk of using unscreened fireplaces.	Flame	Flammable Fabric
28	Given a kitchen scene, identify causes of burn injury (fabric ignition, due to loose towel, loose fitting sleeves) and explain why.	Flame	Flammable Fabric
28	Identify causes of burns associated with storing pressurized cans near heat and cookies over stove.	Flame	Flammable Liquid
49	Recognize and explain that location of burner controls may be a risk for young children or adults who must reach across burners to turn them off or on.	Flame	Ovens/Ranges
16b	Recognize usual results of high voltage accidents.	Electrical	
51	Recognize the function of fuses in preventing electrical fires.	Electrical	Electrical Source
55	Given a living room scene, explain why running an extension cord under a rug is hazardous.	Electrical	Flammable Fabric
55	Given a living room scene, recognize that extension joints may be a source of burn to young children who may suck or poke into them.	Electrical	Electrical Sources/ Extension Cords
60	Recognize risks of using electric space heaters: electrocution, clothing ignition, contact burn.	Electrical	Space Heater
25(73) 25(75)	Given a situation, deduce the cause of death from smoke inhalation as a result of bringing a charcoal grill into a closed, unvented area (lack of oxygen, carbon monoxide).	Smoke	
64(23) 64(25)	Deduce that using an unvented gas space heater in a closed, unvented area could be a cause of death.		Space Heater Space Heater
31	Recognize correct placement of cooking pots on a burner.	Scald	Ovens/Ranges
27	Given a kitchen scene, identify common situations that may cause a scald and explain why.	Scald	
20 21, 22	Recognize the prolonged recovery period and permanent deformity of severe burn injuries.	Chemical	Flammable Liquid

and outlet caps--instead of extension joints and cords--as devices for preventing electrical fires and burns. In response to an open-ended question asking students to change a living room scene to make it safer from fire or burns, only a third saw the extension cord running under the rug as a potential risk because it could fray, overheat, and ignite the rug. Critically, less than 5% realized that extension joints are hazardous because toddlers might suck on them or poke them and get burned. Either children's lips contact the metal male prong or the saliva from their mouths causes an electric arc in the female end; either way, children receive disfiguring electrical burns to the mouth.

Offered a choice of several risks presented by an electric space heater used in the bathroom, most students selected electrocution (44%), while 35% chose a contact burn, and 26% chose clothing ignition. All are correct options.

Other low items included burns related to fabric ignition. Less than half of the students (37%) correctly indicated that a floor-length cotton nightgown (not flame resistant) would burn from hemline to neckline in fifteen to twenty seconds. Just as many (39%) indicated that it would take from fifty seconds to six minutes to burn. Another 19% checked "don't know." Similarly, less than one-third (31%) realized that a boy wearing long cotton trousers would be burned more severely than one wearing shorts, if sparks landed on each boy's leg. More students (37%) believed the boy wearing shorts would be burned more severely. As with younger age groups, a pervasive misconception is evident, that clothing, regardless of fabric type, protects the body from burn injury.

In an open-ended question involving a living room scene, only one-third of the students recognized that sparks from an unscreened fireplace could ignite the chair or the carpeting. In analyzing a kitchen scene, less than 10% of the students explained that storing cereal or cookies over the stove could tempt children to climb on the stove, or be a risk to adults reaching for them over a hot burner. The kitchen scene showed a young girl cooking at a gas burner, wearing a loose robe with loosely hanging sleeves, who is using a long towel as a pot holder. When asked what two things this girl could do to be safer from a possible burn, a large number of students noted the hazard presented by the towel, but less than a third referred to the danger presented by the girl's style of clothing.

Items concerning scalds also fell into the low category. Given a choice between pictures showing full pots on a stove, about 40% correctly chose the picture showing handles turned inward and correct-sized burners. Twenty percent chose the pots with handles turned in but placed on oversized burners. Another 20% chose an obvious danger--the pot handle protruding into the room--while 8% chose the picture presenting both hazards.

Students scored poorly on questions asking them to reason why items in the environment may cause scalds. When asked to analyze a kitchen scene, less than 25% explained that the tablecloth presented a hazard since the toddler in the picture could pull on it and spill the liquid on himself. Less than 10% explained that the mother could spill the hot liquid on the infant she was holding or that the daughter cooking at the stove could spill the contents of her pan on the toddler. Only 7% explained that lack of supervision could be an underlying cause of a burn.

Shown a selection of stoves with control dials located in different positions, students gave some interesting responses. Most students (55%) chose the model with the control dials in front because it isn't necessary to reach across the burners to get at them and they are generally within easy reach. The majority of the sample did not consider the inherent danger to young children, who can also reach them easily. Less than 15% selected the stove with controls on the side, eliminating both the hazard of reaching over the burners and the risk to young children.

Students did moderately well at recognizing hazards associated with storing matches above the stove. Sixty-two percent recognized that the matches could ignite; 56% recognized the risk to someone reaching for them; and 54% recognized the temptation for children to climb on the stove. But 30% indicated that storing matches above the stove "put them safely out of the reach of children," a wrong conclusion.

A second area in which students showed moderate awareness is in predicting results of pouring a flammable liquid onto an ignition source. A majority (57.5%) recognized that pouring lighter fluid on a lighted barbecue could result in a flash back to the can. A small group of students (16%), however, believed this could be done safely in some way (hold the can away from your body, 4%; if no spark flies into the can, 6%; if there is no flame left on the coals, 6%). Another 10% did not know what would happen.

Given the following situation, students were asked to identify plausible explanations of death.

Surprised by rain during a cookout, Nancy carried

> her new charcoal grill into a closed toolshed where she continued cooking the food. She was dead when her husband came to look for her.

Most students (59%) identified smoke inhalation, while fewer students identified the other possible causes--carbon monoxide poisoning (40%) and lack of oxygen in the shed (32.5%).

A similar item described a gas space heater being used indoors. In this case, more students (55%) recognized carbon monoxide poisoning as a cause of death. It seems, therefore, that more students realize that carbon monoxide is given off by gas burners than by burning charcoal. The need for ventilation in conjunction with carbon monoxide gas was unrecognized by many students. Twenty percent indicated that the cause of death was not having the gas space heater vented, while 27% said it was because the windows were closed. Eleven percent said that they did not know why the people died and 10% said death was caused by the room catching fire.

Preventive Behaviors

Knowledge of preventive behaviors ranked second among adolescents, but there were still many deficiencies with respect to flammable liquids and fabrics.

TYPE OF KNOWLEDGE—PREVENTIVE BEHAVIORS

Question Number	Objectives	Type of Burn	Type of Product
HIGH 15(58)	Recognize that to prevent burns one should: Immediately remove clothing which has had a flammable liquid spilled on it.	Flame	Flammable Fabric
MEDIUM 58	Recognize that to prevent burns one should: Plan an outside meeting place as part of a fire drill.	Flame	House Fire
46	Store gasoline in a tightly-capped metal container with a pressure-release valve.	Flame	Flammable Liquid
62	Not pour gasoline or charcoal starter on a slowly burning fire.	Flame	Flammable Liquid
36	Turn off gas, vent room, and wait before re-lighting gas burner.	Flame	Ovens/Ranges
68	Store oily rags in covered metal containers.		Flammable Liquid
18	Never climb utility poles under any conditions.	Electrical	
LOW 15(59) 15(60)	Recognize that to prevent burns one should: Tightly cap containers of flammable liquids.	Flame	Flammable Liquid
48	Not pour flammable liquid into a hot machine.	Flame	Flammable Liquid
43	Wear tightly woven fabrics (denim) or animal fibers (wool) when working near open flame.	Flame	Flammable Fabric
26	Wear tight-fitting, flame-resistant or short-sleeved clothing when cooking at the stove.	Flame	Flammable Fabric
54(63)	Have plug fit securely in extension cord.	Electrical	
(64)	Buy extension cords that allow for only one appliance.	Electrical	
(65)	Not repair frayed cords with electrical tape.	Electrical	
(66)	Tape semi-permanent plugs into place.	Electrical	
65	Locate a space heater 3 feet from any object and use with a screen.		Space Heater
69	Situate smoke detector in bedroom hallway.	Smoke	House Fire

Given a hypothetical situation in which a teenage boy, filling his motorbike, spills gas on his pant cuffs, almost all students said he should change his pants. But only a third checked the other preventive behaviors listed: checking to see if the tops were back on the gas can and on the motorbike gas tank.

When asked about the disadvantages of owning and using power tools, only a third mentioned having to wait to refuel a hot machine, emptying gas out of the tank after each use, and storing extra gas.

For prevention related to clothing, only 20% of the students knew the relatively safer, non-flame-resistant clothing one could wear: "denim jeans and a wool sweater." A third checked "don't know," while 20% said denim jeans and a flannel shirt. (Flannel has a relatively fast burning speed.) In analyzing the kitchen scene, less than 20% said the girl should wear tight-fitting clothes or roll up her sleeves to prevent fabric ignition.

In using extension cords, 45% cited the precaution of "testing the receptacle to make sure the plug fits securely." Another 26% said, "use a cord that allows for only one appliance." Ten percent said, "tape a semipermanent plug into place." A third said that "frayed cords should be repaired with electrical tape," a behavior which is highly likely to cause a fire or burn.

Students seemed to have very little information on the best place to locate a single smoke detector. Only a third suggested the bedroom hallway (the best place). Another 22% suggested the base of the stairs to the second floor, a location from which the warning signal is unlikely to be heard.

Other items related to flammable liquids and house fires were answered moderately well. Students identified metal as the safest container for storing gasoline, but just as many chose the plain, metal-capped can as the can with a pressure-release valve. Storing oily rags in covered metal containers was another well-known preventive behavior. Slightly more than half chose the correct way to relight a gas burner. Twenty percent did not know what to do, and 11% would "turn the gas on higher, open a window, and strike another match." Most high school students did know that the best way to revive an open fire is by fanning it, but 11% said, "add more charcoal starter," a dangerous behavior.

Although students were not aware of the causes and consequences of high tension wire accidents, many (55%) said that it is never safe to climb a utility pole. But 13% said it would be safe because of the misconception that the wires have thick insulation.

Behaviors to Minimize Harm

Need for knowledge about behaviors to minimize harm once a burn is in progress involves reactions in common household fires and care of a burn.

TYPE OF KNOWLEDGE—BEHAVIORS TO MINIMIZE HARM

Question Number	Objectives	Type of Burn	Type of Product
HIGH	Recognize that to minimize harm once a burn or fire is in progress one should:		
61	Drop and roll to extinguish burning clothing.	Flame	Flammable Fabric
MEDIUM	Recognize that to minimize harm once a burn or fire is in progress one should:		
37	First remove clothing which has had a hot liquid spilled on it.	Scald	
47	Crawl when moving through smoke.	Smoke	House Fire
LOW	Recognize that to minimize harm once a burn or fire is in progress one should:		
33	Place a lid on a small grease fire in a pan.	Flame	House Fire
18	Apply cold water to a scald after clothing has been removed.	Scald	
66	Remove source of heat and apply cold water to treat a severe scald.		
34	First pull out the plug and then put water on a fire in an electrical appliance.	Electrical	Space Heater
56	Identify proper procedures to follow during and after a fire (if caught in a fire on the fourth floor, stuff door crack, hang clothing from window, and wait.	Smoke	House Fire

Students did not know how to put out a fire in an electrical heater, nor a grease fire in a pan. Fifty-eight percent checked the option of putting "baking powder" on the grease fire, and 30% said "flour"--both substances which could explode. Only 29% chose the "lid," probably the safest reaction.

> A person on the fourth floor of an apartment building wakes up in the middle of the night and smells smoke. He discovers that his bedroom door is hot. He should:

Given the above situation, about 40% knew that the best response was to "stuff the door crack, hang a piece of clothing from the window and wait"; 20% said "jump to some bushes," an action likely to cause other injuries.

On-the-scene immediate treatment of a burn is an area in which correct knowledge can drastically reduce the harm of the injury. When asked how to treat a scald burn through clothing, half said to remove the apparel, then cool the burn with cold water. Twenty percent said they would apply cold water on top of the clothing. In treating any other type of burn, only 29% checked "remove the source of heat and apply cold water." About a third of the sample said to put ointment or butter on the burn.

Crawling through smoke and the drop-and-roll technique to extinguish burning clothing were well known.

Is Knowledge Related to Selected Sample Characteristics?

Overall knowledge for high school students was analyzed by school district, sex, burn history, socioeconomic status, and previous instruction in burn/fire prevention. The only significant finding that emerged was a knowledge difference across school districts. Although not significant, it is interesting to note that high school girls tended to score higher than boys, a trend which is opposite from the younger samples. As with the fifth graders (although not significant in either case), scores for those who reported that they had at some time been mildly burned tended to be slightly higher. Although not statistically significant, the highest socioeconomic group scored ten points higher than the lowest group. Relevant data follow.

Knowledge by School District

The comparison of mean scores across the school districts for the 50% subsample revealed significant differences. This is very interesting because the standard deviation indicated that there were wide differences within each group. As the table below indicates, the mean scores ranged from 36.0 for District 3 to 47.4 for District 4.

Overall Scores by School District

School District	N	Mean Score*	Standard Deviation
Entire population	208	43.2	14.5
1	40	46.2	14.9
2	43	42.0	14.4
3	34	36.0	14.2
4	47	47.4	14.5
5	42	42.7	12.4

*An ANOVA test on raw scores resulted in rejection of the H^0 at level $\alpha = .05$.

Knowledge by Sex

The mean scores of adolescent boys and girls were not significantly different as indicated below. The recoded score distribution illustrates the similarities between boys' and girls' scores.

Overall Scores by Sex

Sex	N	Mean*	Standard Deviation
Male	107	42.3	15.9
Female	96	44.4	13.0

*A t test on raw scores resulted in failure to reject the H^0 at $\alpha = .05$.

Recoded Scores by Sex*

Sex	N	Low (0-36)	Low Average (37-43)	High Average (44-50)	High (51 & over)
Boys	107	36%	18%	13%	34%
Girls	96	25%	20%	24%	31%

*A chi-square test on raw scores resulted in failure to reject the H^0 at $\alpha = .05$.

When the knowledge of young men and women was compared for each domain, some differences did emerge. Unlike the primary and middle school samples, where girls generally performed less well than boys regardless of how the subscores are arranged, adolescent girls scored significantly higher in several areas. Girls performed better than boys on knowledge of preventive behaviors within the type of knowledge domain, and on flammable fabrics within type of product. Boys, on the other hand, did significantly better, within type of burn category, on knowledge related to electrical and chemical burns. Relevant data appear in the following table.

KNOWLEDGE BY SEX
(expressed in average percent correct)

	Male	Female
ALL ITEMS	31	33
Type of Knowledge		
Facts and Concepts	28	27
General Awareness	34	27
Preventive Behaviors*	40	46
Behaviors to Minimize Harm	40	44
Type of Burn		
Flame	31	34
Scald	34	40
Electrical*	28	24
Smoke	42	45
Chemical	33	21
Type of Product		
Flammable Fabrics*	28	33
Flammable Liquids	32	30
Space Heaters	33	30
House Fires	46	48
Matches/Smoking Materials	54	57
Ovens/Ranges	34	31
Electrical Sources	26	23
Fireplaces		

*A t test resulted in rejection of the H^0 at level $\alpha = .05$.

Knowledge by Burn History

Somewhat surprisingly, the data for the adolescent sample, as with the fifth graders, did not support the assumption that people who have experienced burns, either mild or severe, have more knowledge about burn and fire prevention. As the following table indicates, there was no significant difference between the means of students who had been burned and those who had not.

Overall Scores by Burn History

Burn History	N	Mean Score*	Standard Deviation
SEVERELY BURNED (badly enough to go to a doctor or hospital)	12	40.2	13.9
MILDLY BURNED	93	45.6	13.9
NEVER BURNED	86	42.9	15.1

*An ANOVA test on raw scores resulted in failure to reject the H^o at level α = .05.

Knowledge by Socioeconomic Status

As noted, a "1" on Hollingshead's socioeconomic scale indicates the highest grouping with respect to occupation and education, while a "5" is the lowest. A somewhat unexpected result is that there were no significant differences among the means of the five socioeconomic positions, although the "1" group did score ten points higher than the "5" group.

Overall Scores by Socioeconomic Status

SES	N	Mean*	Standard Deviation
1	23	49.1	14.7
2	36	46.6	12.3
3	49	45.9	12.3
4	50	44.9	14.2
5	10	39.8	13.1

*An ANOVA test on raw scores resulted in a failure to reject the H^o at level α = .05.

Knowledge of Previous Fire/Burn Safety Information

About 66% of the students in the adolescent sample reported that they had previously received fire or burn safety information. There was a slight tendency for persons who had received fire/burn information to score higher than those who had not.

Previous Burn Prevention Information	N	Mean*	Standard Deviation
Yes	132	44.8	14.6
No	67	40.7	14.3

*A t test on raw scores resulted in failure to reject the H^0 at level $\alpha = .05$.

Adults 20 to 59 Years of Age

Summary: Adults 20 to 59 Years of Age

Burn injuries to adults ages 20 to 59 comprise 43% of the state burn data, while this same group comprises 47.8% of the total Massachusetts population. State incidence data indicate that scalds (37%) and flame burns (33%) occur with almost equal frequency for all adults, although flame burns (38%) are somewhat more prevalent than scalds (35%) for the older group (ages 45 to 59).* (This increase in flame burns after age 45 is a departure from the pattern of frequency in all younger age groups, where scalds outstandingly outnumber flame burns.) Contact (12%), chemical (8%), radiation (3%), and electrical burns (1%) occur infrequently. As with most other age groups, males tend to be burned more often than females.

The profile data on adult burn victims residing within the Boston SMSA (experimental site) allow certain generalizations:

- Scalds happened most often in the kitchen while people were preparing, serving, or eating food. An accident tended to occur when the person involved was hurried, troubled, or preoccupied.
- Flame burn accidents usually occurred when the victim was smoking in bed or in an overstuffed chair, left the gas jet on too long before lighting the burner, or contacted the stove while wearing flammable clothing.
- Although scalds occurred almost as frequently as flame burns, the majority of scalds were less extensive, less serious injuries. However, a few scalds resulted in

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*Because the age span of this group is so broad, we sometimes refer to "younger adults" (20 to 44) and "older adults" (45 to 59).

severe injuries and required lengthy hospitalization. Flame burns were more severe in every dimension: length of hospital stay, extent of body burned, involvement of face and hands.

- Clothing ignition in flame burn accidents was more common among the older adults (68%) than younger adults (42%), with daywear being ignited somewhat more often than nightwear.
- Younger adults tended to be injured by flammable liquids, especially gasoline, in work situations (57%), whereas older adults were more apt to be injured by cigarette lighter fluid (36%).
- Disabilities were contributing factors in one-third of the burn injuries to older adults. Of all the disabilities noted in the investigations, the consumption of alcohol was mentioned most frequently.

The educational diagnosis revealed many deficiencies and misconceptions in adults' knowledge of burn patterns for their age group:

- Overall scores for adults clustered toward the lower end of the range, with an average of only 44% correct.
- Adults were generally unaware of the causes and consequences of burn injury and knew very few underlying facts and concepts. Although they scored much better on behaviors to minimize harm, reports of the actual behaviors of victims in emergency situations seem to indicate that they did not practice these behaviors. For example, victims of clothing ignition often panicked and screamed or ran, rather than dropping and rolling to extinguish the flames.
- Although scalds were a major source of harm to adults, those who were tested appeared to be fairly knowledgeable about scalds. Adults scored low, however, on knowledge of flame burns, the most severe type of burn injury for adults. Scores were particularly low on flame burn items pertaining to flammable fabrics and liquids.

Scalds

When asked about scalds, adults were unable to:

- Recognize that scalds are the most common type of burn for adults and children under 3.

- Recognize correct steps for immediate treatment of a severe scald (first remove clothing, then apply cold water).

Flame

Adults tended to get severe flame burns while lighting fires, or being near or using an ignition source. For a majority of the older adults, clothing was ignited. Flammable liquids were involved more prominently in flame burns to younger adults, ages 20 to 44.

The specific knowledge goals for which adults exhibit large deficiencies are presented below for flame burns and some of their related products.

Flammable Fabrics

With regard to flammable fabrics, adults were unable to:

- Identify the relative burning speed of common fabrics and select fabrics and styles of clothing that are not flame resistant but are relatively more fireproof.
- Define what is meant by flame-resistant fabrics and recognize current federal regulations of fabric flammability.
- Recognize correct maintenance of flame-resistant fabrics.
- Identify proper clothing to wear while cooking and recognize that only potholders or oven mitts should be used for removing pots from the stove.
- Explain why unscreened fireplaces, electric cords under rugs, and food stored over the stove invite risks of fabric ignition.

Flammable Liquids

Concerning flammable liquids, adults did not:

- Recognize the properties of flammable liquids (vapors are heavier than air and gather in low places).
- Identify causes of burns associated with storage of pressurized cans near heat.
- Explain how to store flammable liquids safely to prevent fires.

Matches and Smoking Materials

Although knowledge of fire and burn safety regarding matches and other smoking materials was high, many adults were injured in smoking accidents. The reason appears to be that such accidents occur when the individual combines drinking (or some other disability) with smoking in bed or in an overstuffed chair.

Most of the adults tested have received information regarding fire or burn safety at some time during their lives. The main sources of this information were teachers in school and television. These adults apparently get a great deal of information (and entertainment) from television; most watch it every night of the week between 6 and 11 PM.

The educational diagnosis also indicated that overall knowledge is not significantly related to age, sex, socioeconomic status, or income.

Telephone Survey

The telephone survey revealed the areas where there is greatest need of educational intervention for adults. Respondents to the telephone survey scored low in their ability to:

- Recognize a definition of flame-resistant fabrics.
- Distinguish types of clothing and fabrics most likely to catch fire.
- Recognize that overhead transmission lines are *never* insulated.
- Recognize that scalds are the most common type of burn for adults and for children under 3.
- Recognize that electrical burns to children under 3 usually result from their chewing on cords.
- Recognize the correct steps for immediate treatment of a severe scald (remove clothing).

Additionally, the survey revealed that adults in general do not:

- Store flammable liquids safely to prevent fires.

- Practice a plan of action for fires.

- Have a fire extinguisher and a smoke detector in their homes.

- Purchase flame-resistant clothing.

Both the telephone survey and the criterion-referenced test identified two main areas for which educational intervention is needed: flammable fabrics and flammable liquids. Both the interview and the telephone survey indicated that even when knowledge of preventive behaviors is high, many such behaviors are not practiced.

Burn Injuries Occurring to Adults 20 to 44 Years of Age

State Burn Incidence Data

Approximately one-third (201 out of 611 = 32.9%) of the state's reported burn population was between 20 and 44 years of age. This age group also accounts for about a third (30.9%) of the total population of Massachusetts. Of the 154 victims for which sex was coded, 95 (61.7%) were male and 59 (38.3%) were female. Because only 49% of the total Massachusetts population aged 20 to 44 is male, men are somewhat overrepresented in the burn group. Of these burn patients, 78% were treated and released, 21% were hospitalized, and one case (0.5%) was dead on arrival.

The distribution of burn injuries by type of burn is presented in the following table.

	Scald	Flame	Contact	Chemical	Radiation	Electrical	Unknown
N	74	67	28	17	7	2	6
%	37%	33%	14%	8%	3%	1%	3%

Scalds = 36.8% (74 cases)

Scalds happened to adults in a number of ways, but the most common were kitchen/cooking/serving accidents (36 cases, 48.7%). Other types of scalds included six industrial process scalds (8.1%), six from auto radiators (8.1%), and one scald from a dishwasher (1.4%). Two scalds (2.7%) occurred under other circumstances; for the other 23 (31.1%) the circumstances were left unspecified.

Flame Burns = 33.3% (67 cases)

One-third of the burns to younger adults identified through the state reporting system were flame burns. The largest number of flame burns for this age group occurred while the victim was lighting a fire or the stove or using matches (fifteen cases, 22.4%) or was near an ignition source or explosion (fourteen cases, 20.9%). Other flame burns occurred while the victim was using a flammable substance (ten cases, 14.9%) or an ignition source such as the stove (ten cases, 14.9%). Nine flame burns (13.4%) were the result of structural fires. Four cases (6.0%) fell into "other" categories (two were transportation accidents) and for the remaining five cases the circumstances were unknown.

Clothing was ignited in almost one-third of the flame burn accidents for this age group (twenty cases). Pants or shorts were most frequently ignited (eight cases). Other items ignited included: outer wear, shirts or blouses, street wear, nightgowns, and a housecoat or robe. The other items were not specified. The most common cause of ignition was using a flammable substance (five cases). Only one case of clothing ignition was caused by a stove.

Contact Burns = 13.9% (28 cases)

Contact burns were sustained in 28 of the 201 cases reported for this age group. The items contacted included: stoves (six cases, 21.4%), other cooking equipment such as hot pans (seven cases, 25%), radiators (three cases, 10.7%), irons (two cases, 71.1%), hot water pipes (two cases, 7.1%), smoking materials (two cases, 7.1%), and other items (six cases, 21.4%).

Other Burns = 15.9% (32 cases)

Chemical burns constituted 8% (seventeen cases) of this group's injuries. Of these, males tended to be the victims of industrial spills and battery explosions; females tended to be the victims of accidents involving household cleaning substances. In seven cases (3%), the victims' burns resulted from radiation all caused by sunlamps. Two electrical burns occurred in this group, one from a hospital defibrillator and one while working on the electrical distribution system at work.

Burn Injuries Occurring to Adults 45 to 59 Years of Age

State Burn Incidence Data

Of the state's reported burn population, 10.3% (63 out of 611), seven of the victims were between the ages of 45 and 59. This age group constitutes 16.8% of the total Massachusetts population. Although women predominate in this age group in the total Massachusetts population (women 53%, men 47%), men predominate in the group of burn victims. Of the 47 victims coded for sex, 29 were male (61.7%) and 18 were female (38.3%). Sixty-nine percent of this age group of burn victims were treated in the emergency room and then released; 31% were hospitalized.

The distribution of injuries by type of burn is presented in the following table.

	Scald	Flame	Contact	Chemical	Radiation	Unknown
N	21	24	4	4	1	9
%	33%	38%	6%	6%	2%	14%

Scalds = 33.3% (21 cases)

Eleven of the scalds (52.4%) were kitchen/eating related. Only one domestic water system scald (4.8%) was reported for this age group (a steam bath/sauna injury). Nine scalds (42.9%) occurred under unspecific circumstances.

Flame Burns = 38.1% (24 cases)

Unlike younger age groups, flame burns accounted for a slightly larger percent of the burns to adults age 45 to 59 than did scalds. These flame burns occurred most frequently (six cases, 25%) while the victim was using an ignition source--usually a stove--or happened to be near an explosion (five cases, 20.8%). Other flame burns occurred while the victim was lighting a fire or using matches (three cases, 12.5%), using a flammable liquid (two cases, 8.3%), or was in a house fire (two cases, 8.3%). The remaining six cases (25%) happened under "other" circumstances.

The victim's clothing caught fire in four of these accidents. Two victims had their shirts catch fire; one victim's robe caught fire while he was trying to light a cigar from the stove and another victim's pajamas caught fire when s/he was smoking in bed or in an upholstered chair.

Contact Burns = 6.3% (4 cases)

Contact burns were sustained in four of the 63 cases reported for this age group. The items contacted were: a hot pan, a heating pad, a hot water pipe, and a cigarette, cigar or pipe.

Other Burns = 7.9% (5 cases)

Four of the five other burns were chemical burns. Of those chemical burns, two resulted from battery explosions and one happened while the victim was doing household chores. The circumstances of the other chemical burn were not specified. The fifth burn victim suffered a sunburn.

Burn Victim Profile Data

What Are the Characteristics of Adult Burn Victims?

The group of adult burn victims included 239 persons, ages 20 to 59, from the Boston SMSA (experimental site). The following table describes these victims in terms of sex, race, household type, occupation, education, and marital status.

DEMOGRAPHIC CHARACTERISTICS: ADULTS 22-59 YEARS

	N	% Total	% Respondents
Sex			
Male	83	34.7	34.7
Female	156	65.3	65.3
Race			
White	219	91.6	92.4
Black	18	7.5	7.6
No Answer	2	0.8	—
Household Type			
Live Alone	22	9.2	10.0
Parents and Offspring in Residence	121	50.6	54.7
Married Adults Without Children	34	14.2	15.4
Single Parent and Offspring	22	9.2	10.0
Related Adults, Not Married	11	4.6	5.0
Unrelated Adults	8	3.4	3.6
Other	3	1.3	1.4
No Answer	18	7.5	—
Occupation			
Employed Full Time	117	49.0	51.5
Employed Part Time	11	4.6	5.0
Student	9	3.8	4.0
Housewife	69	28.9	30.4
Unemployed	18	7.5	7.9
Retired	3	1.3	1.3
No Answer	12	5.0	—
Education			
Grade School	5	2.1	2.9
Partial High School	33	13.8	19.1
High School Graduate	71	29.7	41.0
Partial College	38	15.9	22.0
College Graduate	19	8.0	11.0
Graduate School	7	2.9	4.1
No Answer	66	27.6	—
Marital Status			
Married	153	64.0	65.1
Widowed	6	2.5	2.6
Divorced/Separated	27	11.3	11.5
Single	49	20.5	20.9
No Answer	4	1.7	—

Approximately two-thirds (65%) of the victims are women and almost all are white (92%). Over half (65%) live in nuclear family units, with no more than 10% from any other type of household. Sixty-four percent are presently married. Nearly half (49%) are employed full time; 29% are housewives; and 8% are unemployed. The others are employed part time (5%), students (4%), or retired (1%).

A relatively large percentage of the victims (28%) did not give their educational background. Of those who did, the largest number (41%) are high school graduates, followed by persons who have had some college (22%) and persons who have not completed high school (19%).

What Types of Burn Accident Happen to This Age Group?

As with other age groups, scald and flame burns occurred most frequently. The distribution of burns in the profile data is shown on the table below.*

	Scald	Flame	Contact	Chemical	Radiation	Electrical
N	44	157	15	5	12	6
%	18%	66%	6%	2%	5%	3%

What Is the Relative Severity of the Burn Injuries in This Age Group?

The following table describes the severity of the burns incurred by these adults.

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*The distribution by type of burn in this sample differs from the burn-type distribution in the state-reported burn incidence data. This sample reflects the interests and mandate of the agencies (BISU and CPSC) which conducted the investigations. A major focus of both agencies was flammable clothing, since federal legislators were considering the need for federal standards to regulate the flammability of clothing. Hence, the sample includes a disproportionate number of severe flame burns. However, the severity of these burn injuries (discussed below) provides justification for studying this kind of accident in depth.

BURN INJURY INVESTIGATION DATA:
MEDICAL FACTORS FOR ADULTS 22-59 YEARS

		% Respondents			
	N	All Burns	Scald	Flame	Other
Medical Treatment	N= 239		44	154	37
Treated and Released	169	72	95	63	81
Expired	11	5	—	7	—
Hospitalized	55	23	5	30	19
Not Ascertained	4				
Length of Hospital Stay					
Not Hospitalized	176				
Hospitalized	N= 55		43	150	38
1-9 days	7	13	—	10	33
10-29 days	18	32	—	33	33
30-49 days	16	24	—	29	33
Over 50 days	14	25	100	27	—
Extent of Burns					
Total Body Surface Area Burned	N= 239		44	157	38
Less than 5%	117	49	64	41	65
5-19%	53	22	11	27	13
20-39%	12	5	2	7	—
More than 40%	57	24	23	25	21
Body Surface Area With Third Degree Burns:					
No Third Degree Burns	42				
With Third Degree Burns	N= 197		42	121	34
Less than 5%	182	92	98	88	100
5-19%	6	3	2	4	—
20-39%	4	2	—	3	—
More than 40%	5	3	—	4	—
Body Area Injured					
Was Face Involved?	N= 239		44	153	37
No	144	62	75	56	68
Yes	90	39	25	44	32
Not Ascertained	5				
Were Hands Involved?	N= 239		40	149	37
No	117	52	73	46	54
Yes	109	48	28	54	46
Not Ascertained	13				
Were Genitalia Involved?	N= 239		44	148	37
No	216	94	98	93	97
Yes	13	6	2	7	3
Not Ascertained	10				

Only 5% of the victims died as a result of their burns. Most (72%) were treated in emergency rooms and released, but nearly one-quarter (23%) were hospitalized. Of those who were hospitalized, 32% stayed for 10 to 29 days, 29% for 30 to 49 days, and 25% for 50 days or longer. Only 13% were hospitalized for less than 10 days.

Other measures of burn severity are amount of body surface burned and part of body burned. Sevency-one percent burned less than 20% of their body surface; but nearly one-fourth (24%) burned over 40% of their bodies. Regarding part of body burned, 39% of the burns involved the victim's face and 48% involved hands; only 6% involved genitalia.

When the types of burns are compared by patient disposition, flame burns appear most severe. A larger percentage of flame burn victims were hospitalized (30% compared to 5% of the scald victims and 19% of the other burn victims); and all fatalities were attributed to flame burns.

The majority of persons who received flame burns were treated in the emergency room and released (63%), but a few (7%) died as a result of their injuries. Of those who were hospitalized, 10% remained 1 to 9 days, 33% remained 10 to 29 days, 29% remained 30 to 49 days, and 27% stayed more than 50 days. In terms of body surface burned, a majority of the victims (59%) burned more than 5% of their body surface area. The victim's face was involved in 44% of the flame burn injuries, hands in 54%, and genitalia in only 7%.

Of the 44 adults who were scalded, nearly all (95%) were treated and released; the one individual who was hospitalized remained there over fifty days. A majority of these victims (64%) burned less than 5% of their body surface area; 11% received burns affecting 5 to 20% BSA; 2% between 20 and 40% BSA; and 23% over 40% BSA.

When, Why, and How Do Injuries Occur?

Scald Burns

These accidents can be grouped in general categories according to what the victims were doing at the time of the accident.

- 22 were preparing, serving, or drinking coffee, tea, or water
- 7 were cooking with grease or oil
- 4 were preparing, serving, or eating soup, chowder, or stew

- 2 were scalded by the domestic hot water system
- 6 incurred other domestic scalds
- 1 was scalded by an auto radiator

Examination of accident factors revealed that the scalds happened in fairly equal numbers throughout the year, with somewhat fewer occurring in the spring. Scalds were slightly more likely to occur during the weekend, in the kitchen of the victim's home, and between noon and 6 PM. Overall, many more women than men were scalded; three-fourths of the victims were women. Most victims (91%) admitted having been injured as a result of their own activity; only 7% were innocent bystanders. Few (7%) had disabilities that contributed to their accidents.

Eight patients were interviewed by project staff. Thumbnail sketches of their accidents follow.

> A 20-year-old man was scalded at work in a restaurant while trying to clean above the fryer. He was standing on the metal sheet covering the fryer when the cover slipped and he fell into the hot grease. (Hospitalized 55 days.)
>
> A 25-year-old man was scalded while trying to let out radiator pressure; victim had been drinking the night before. (Not hospitalized.)
>
> A 29-year-old woman was scalded while hurrying to prepare dinner for family. Victim was draining spaghetti and accidentally spilled cooking water on foot. Victim stated she was bothered by something when accident occurred. (Not hospitalized.)
>
> A 29-year-old man was scalded while trying to move a pan of burning oil; victim had left oil unattended to chat with company. (Not hospitalized.)
>
> A 34-year-old female was scalded while standing in cafeteria line. Man in back of her bumped her and spilled the contents of her coffee. (Not hospitalized.)
>
> A 35-year-old woman was scalded when she splashed herself with cooking juices while trying to salvage a burning roast by turning it with two small forks. She had been chatting on the phone when she realized the roast was burning. (Not hospitalized.)
>
> A 40-year-old woman was scalded by spaghetti sauce when,

while backing away from stove, she tried to avoid cat in back of her and lost her balance. Victim states she was tired, in a bad mood, and in a hurry. (Not hospitalized.)

A 42-year-old woman was scalded when containers of coffee and tea she had purchased ruptured through bag, spilling the contents on her legs. (Not hospitalized.)

The interviews revealed that hurrying, preoccupation, and poor judgment seemed to be major factors in several of the accidents. It was poor judgment to climb on top of a fryer even though it was covered, to move a burning pan of oil, or to try and turn a large roast with two small forks.

With regard to emergency first aid, all but two patients were treated appropriately. When clothing was involved, it was removed. Cold water was applied to the burned areas to ease the pain. In the two instances where emergency treatment was not appropriate, butter or vaseline was applied to the wound. In the first case, the individual had learned while young that "butter was good for small burns." In the second instance, the victim wanted to apply butter but none was available so he applied vaseline.

In four instances, however, individuals underestimated the burns. Family had to encourage them to seek treatment. In two of the work accidents, the victims were impressed by the lack of concern on the part of their employers, and initiated further treatment on their own.

Flame Burns

The victims' activities at the time of the burn accident can be grouped as follows:

- 56 were lighting fires
- 37 were actively using or working with ignition sources
- 27 were using flammable substances
- 22 were near but not actively using ignition sources
- 7 were involved in house fires
- 5 were in other accidents

Flame burn accidents occurred slightly more often in the fall (30%) and slightly less often in the spring (15%). They were slightly more likely to occur on weekends (relative to week days), between noon and 3 PM or between 9

PM and midnight. Nearly all accidents (83%) occurred in the victim's home, usually in the kitchen (53%). In 19% of the cases, the victim suffered some disability that impaired functioning (16% of the younger adults, 33% of the older adults). Eighty percent were injured as a result of their own activity; only 6% were innocent bystanders.

In many instances the victim's first response was to run or to try to extinguish the flames with hands, feet, or an object. Relatively few dropped and rolled or wrapped themselves in a blanket or rug.

The products involved in many of these accidents included flammable liquids (natural gas, gasoline, cooking grease), flammable fabrics, ovens/ranges, and matches and other smoking materials. Burns to the younger age group were more likely to involve flammable liquids, while burns to the older age group were more likely to involve flammable fabrics.

Seventeen patients or families were interviewed in depth.

Smoking Accidents

> A 34-year-old man, with a history of Huntington's Chorea, dropped a cigarette on his shirt. Because of his disease he could not retrieve it rapidly; the shirt was burned completely. (Hospitalized 42 days.)
>
> A 34-year-old woman, with a history of epilepsy, had an epileptic seizure while smoking; dropped cigarette on body and ignited clothing. Smoke detector warned neighbors of her predicament. (Hospitalized approximately 212 days; part of one arm amputated.)
>
> A 57-year-old woman probably set fire to her clothes when she dropped cigarette on herself. Victim had a history of heavy smoking and drinking. Neighbors called fire department after seeing smoke coming out of victim's apartment. (Dead on arrival.)

These case histories illustrate the severity of flame burns. They also illustrate the dangers of habitual smoking, flammable clothing, and alcohol. Even when precautions had been taken (a smoke detector had been installed), the consequences were dire. In all instances, the victim was alone at the time of the accident.

Other Flammable Fabric Accidents

> A 27-year-old man was burned when daughter's pinafore caught on fire; he tried to extinguish flames with his hands. (Not hospitalized; hands were badly burned and victim could not work for two months.)
>
> A 37-year-old woman was injured while rushing to make husband's dinner. While making coffee, victim leaned over stove, knowing it was not safe. Clothing ignited, victim panicked and couldn't drop and roll, sister beat out flames. (Not hospitalized.)
>
> A 34-year-old woman was burned when her shirt ignited as she turned her back to the stove; husband tackled wife to drop and roll. (Hospitalized 23 days.)

Panic and instinctive action often take precedence over learned behaviors at times of emergency. In the case where the father attempted to extinguish his child's pinafore by slapping at the flames with his hands, the father stated that he knew he was doing the wrong thing, but that his reaction was "instinctive." Neither of the women was able to extinguish the flames herself; both needed the intervention of a second person. The "woman in a hurry" knew she was exposing herself to danger by leaning over the stove, but it seemed expedient. She explained that when her clothing ignited, she remembers thinking about alternatives of how to put out the fire, but was unable to act on any. Her sister finally beat out the flames with a sweater she had in her hands.

Flame Burns from Explosions

> A 27-year-old man was injured when a can of duplicator fluid that had been stored incorrectly exploded. (Hospitalized 70 days.)
>
> A 34-year-old man was hurt when an embossing machine he was working on malfunctioned and exploded with an ensuing fire. Impact of explosion hurled victim 150 feet and charred his clothing. (Hospitalized 30 days.)
>
> A 33-year-old woman was involved in an explosion caused by a leaking gas main in neighborhood. Impact of explosion blew up house and caused house fire. (Hospitalized 48 days.)
>
> A 38-year-old man was hurt when a boiler he was trying to repair exploded. (Not hospitalized.)

> A 41-year-old man was using a substance labelled "sulfuric acid" to flush drain; substance exploded in his face. (Hospitalized 7 days.)
>
> A 44-year-old oil burner repairman was involved in an explosion caused by a leaking gas main in the neighborhood where he was working. (Hospitalized 17 days.)
>
> A 49-year-old fireman was injured while fighting a fire when gases caused explosion. Victim was not wearing protective gloves; firefighting coat ignited. (Hospitalized 36 days.)

Accidents related to work or resulting from malfunctioning equipment are well represented here. Many of the victims were trained to handle such situations, and were prepared for emergencies. One boiler repairman had intentionally worn a heavy, protective vest in case of an explosion; he was not injured seriously enough to require hospitalization. The firefighter admitted that it was poor judgment not to use gloves and to enter the house through the front door which apparently caused a vacuum and a gush of wind. The ignition of his coat was a surprise to department members; the garment apparently did not meet its advertised standards.

In some cases, the emergency was unexpected, the victim was ill prepared, and injuries were more severe. In the explosion caused by a leaking gas main, the owner of the house called the repairman because she thought something might be wrong with her boiler. Because her home did not use gas, she had not been warned by the gas company, as her neighbors had, that a gas main in the neighborhood was malfunctioning.

Other Types of Burns

This category includes contact (6%), electrical (3%), radiation (5%), and chemical burns (2%). The contact burns involved radiators and stove surfaces. The radiation burns involved sunlamps, a frequent type of burn among adolescents and younger adults. One characteristic of sunlamp burns is that the symptoms of the injury appear several hours after sunlamp use; therefore, medical treatment for these burns is often delayed until the pain becomes intolerable. A danger in this kind of accident is the potential hazard to the eyes.

Four patients who sustained burns in these categories were interviewed by project staff.

> A 20-year-old male, on his way home from a night of drinking, followed when his male drinking companion climbed a high tension pole. Victim started to fall and grabbed hold of wire; no clothing ignition. (Hospitalized 17 days.)

A 21-year-old female, with a history of epilepsy, had a seizure in the bathroom and fell against radiator. Victim had attempted to readjust own seizure medication. (Not hospitalized.)

A 27-year-old male, cleaning a large fish tank at work, backed up against a 150-watt light bulb. (Not hospitalized.)

A 28-year-old male burned his hand while helping an acquaintance fix a VW generator belt. Noted blisters and pain several hours later. (Not hospitalized.)

The case of the 20-year-old male who sustained an electrical burn is an example of adolescent risk-taking behavior. He and a friend climbed the pole "for a lark." This accident is typical of high tension electrical accidents among younger adolescents, except that alcohol consumption is a factor here. It is characteristic that the victim was with one or more of his peers, and that "better judgment" was abandoned temporarily. The patient's burns were less severe than usual for such accidents.

The contact burns were least severe (no hospitalization), and, because of the contoured surface of the human body, were less extensive than any other type of burn. The simple contact burn is, unfortunately, a common phenomenon in the average kitchen.

Educational Diagnosis: General Adults and Parents of Children Under 3

Characteristics of the Adult Sample

The total adult sample completing both the interview and the criterion-referenced test consisted of 57 adults from the Boston SMSA (experimental site). The three subgroups within the total adult sample included general adults (people between 19 and 65 with no children under 3), parents having at least one child under 3 living at home, and elderly adults (over 65 years of age). The table on the following page describes the characteristics of the general adults and parents of children under 3 in terms of sex, age, race, marital status, socioeconomic status, income, family size, age of children, burn history, and sources of burn and fire safety information. The characteristics of the elderly group are discussed later with the findings for their group.

The two subgroups discussed here (general adults and parents of children under 3) were quite similar on several characteristics, but there were noticeable differences. These differences are probably attributable to the different sampling procedure used for each group. The random telephone survey across the entire SMSA was the sole source of information about the general adult group, while the parents of children under 3 were selected from clinics in two selected communities, one of which is heavily biased to middle-class citizens. Both sexes were represented about equally among general adults (males 41%, females 54%), but the parents of children under 3 were almost all women (89%, males 7%). Parents of children under 3 also tended to encompass a smaller age range (23 to 44) than adults (19 to 52). Almost all parents of children under 3 were married (96%), but only 58% of the general adults.

Socioeconomic status (SES) was determined by using Hollingshead's five-point scale which is based on the occupation and

DEMOGRAPHIC CHARACTERISTICS

	General Adults (N=29)			Parents of Children Under Three (N=28)		
	N	% Total	% Respondents	N	% Total	% Respondents
Sex						
Male	12	41.4	41.4	2	7.1	7.4
Female	17	58.6	58.6	25	89.3	92.6
No Answer	—	—	—	1	3.6	—
Age						
15-24	9	31.0	31.0	3	10.7	10.7
25-34	10	34.5	34.5	20	71.4	71.4
35-44	6	20.7	20.7	5	17.9	17.9
45-54	4	13.8	13.8	—	—	—
Race						
Black	2	6.9	6.9	—	—	—
White	27	93.1	93.1	28	100.0	100.0
American Indian	—	—	—	—	—	—
Spanish	—	—	—	—	—	—
Oriental	—	—	—	—	—	—
Other	—	—	—	—	—	—
Marital Status						
Married	17	58.6	58.6	27	96.4	96.4
Separated	1	3.4	3.4	1	3.6	3.6
Never Married	11	37.9	37.9	—	—	—
Socioeconomic Status						
High	5	17.2	22.7	5	17.9	18.5
	4	13.8	18.2	14	50.0	51.9
Middle	7	24.1	31.8	4	14.3	14.8
	5	17.2	22.7	4	14.3	14.8
Low	1	3.5	4.6	0	—	—
No Answer	7	24.1	—	1	3.6	—
Income						
Under $5,000	5	17.2	17.2	2	7.1	7.4
$5,000-10,000	6	20.7	20.7	1	3.6	3.7
$10,000-15,000	8	27.6	27.6	11	39.3	40.7
$15,000-20,000	3	10.3	10.3	4	14.3	14.8
$20,000-25,000	2	6.9	6.9	4	14.3	14.8
Over $25,000	5	17.2	17.2	5	17.9	18.5
No Answer	—	—	—	1	3.6	—
Number in Household						
1-4	23	79.3	79.3	22	78.6	78.6
5-6	6	20.7	20.7	3	10.7	10.7
7 or more	0	—	—	3	10.7	10.7
Number of Children Under 3 Years						
0	28	96.6	96.6	—	—	—
1	1	3.4	3.4	25	89.3	89.3
2	0	—	—	3	10.7	10.7
Number of Children 3-16 Years						
0	18	62.1	62.1	15	53.6	53.6
1	2	6.9	6.9	9	32.1	32.1
2	5	17.2	17.2	2	7.1	7.1
3 or more	4	13.8	13.8	2	7.1	7.1

education level of the major wage earner (with "1" the highest, indicating professionals with graduate education, and "5" the lowest, indicating semi- or unskilled workers who have not completed high school). Using this classification, the SES of the general adult sample was somewhat lower than the other group. The distribution of the SES for the general adult sample divided roughly into thirds: 41% in the two highest groups; 32% in the middle group; and 27% in the two lowest groups. Over two-thirds of the parents of children under 3 (70%) fell in the two highest groups. These parents were also more likely than the general adult sample to fall in the upper income brackets. Almost half (48%) reported their total family income to be greater than $15,000, compared to one-third of the general adult sample.

In terms of family size, a large majority (79%) of both groups represent families of one to four persons.

The following table shows the burn history of the two groups of adults.

DEMOGRAPHIC CHARACTERISTICS

	General Adults (N=29)			Parents of Children Under Three (N=28)		
	N	% Total	% Respondents	N	% Total	% Respondents
Burn History						
Burned	6	20.7	20.7	4	14.3	14.3
Never Burned	23	79.3	79.3	24	85.7	85.7
Type of Burn						
Scald	4	13.8	66.7*	—	—	—
Contact	2	6.9	33.3	4	14.3	100.0*
Fire Safety Information						
No Answer	1	3.4	—	2	7.1	—
No	9	31.0	32.1	1	3.6	3.7
Yes:	19	65.5	67.9	25	89.3	92.6
Teacher	6	20.7	31.6**	12	42.9	48.0**
TV	5	17.2	26.3	21	75.0	84.0
Fire Department	4	13.8	21.1	21	75.0	84.0
Scouting	4	13.8	21.1	8	28.6	32.0
Work	2	6.9	10.5	10	35.7	40.0
Literature	2	6.9	10.5	22	78.6	88.0
Movie	1	3.4	5.3	4	14.3	16.0
Other	4	13.8	21.1	12	42.9	48.0

* % of persons who had been burned (N=6,4).
** % of persons who had received fire or burn safety information (N=19,25).

As shown, 21% of the general adult sample and 14% of the parents of very young children indicated that they had been burned at some time during their lives. Most of the general adult sample who had been burned had been scalded (67%), while about a third had suffered contact burns (34%). All of the other group who had been burned had contacted a hot object.

A majority of each subsample of adults had received some fire or burn safety information. More parents of young children (84%) had received such information than the general adult sample (66%); the former also cited the greatest number of different sources. It is interesting that each group ranked various sources of information differently. Literature ranks first for parents of children under 3, but it is second-to-last for the general adult sample. Television and teachers were high for both groups.

Media Habits

As shown in the following table, approximately 75% of the total sample said they watch television every day of the week. The most popular time is 8 to 11 PM (51%), followed by 6 to 8 PM (23%). About 10% of the parents of young children reported that they watched TV from 8 to 12 AM and 4% from 4 to 6 PM; none of the general adult sample watched TV at these times. Radio was much less popular; when asked for a time when they usually listen, 40% did not reply. Those who do listen said they do so mainly in the early morning.

MEDIA HABITS

	General Adults (N=29)		Parents of Children Under Three (N=28)		Total Experimental Sample (N=57)		
	N	%	N	%	N	% Total	% Respondents
Days/Watch TV							
Monday	24	82.8	22	78.6	46	80.7	80.7
Tuesday	24	82.8	22	78.6	46	80.7	80.7
Wednesday	21	72.4	21	75.0	42	73.7	73.7
Thursday	22	75.9	21	75.0	43	75.4	75.4
Friday	23	79.3	22	78.6	45	79.0	79.0
Saturday	24	82.8	20	71.4	44	77.2	77.2
Sunday	20	69.0	20	71.4	40	70.2	70.2
Time/TV							
6-8 AM	1	3.4	—	—	1	1.8	2.0
8-10 AM	—	—	2	7.1	2	3.5	3.9
10-12 Noon	—	—	1	3.6	1	1.8	2.0
12-2 PM	1	3.4	1	3.6	2	3.5	3.9
4-6 PM	—	—	1	3.6	1	1.8	2.0
6-8 PM	7	24.1	6	21.4	13	22.8	25.5
8-11 PM	14	48.3	15	53.6	29	50.9	56.9
After 11 PM	1	3.4	1	3.6	2	3.5	3.9
No Answer	5	17.2	1	3.6	6	10.3	—
Time/Radio							
6-8 AM	9	31.0	13	46.4	22	38.6	64.7
8-10 AM	4	13.8	5	17.9	9	15.8	26.5
10-12 Noon	1	3.4	—	—	1	1.8	2.9
12-2 PM	—	—	—	—	—	—	—
4-6 PM	1	3.4	1	3.6	2	5.3	5.9
6-8 PM	—	—	—	—	—	—	—
8-11 PM	—	—	—	—	—	—	—
After 11 PM	—	—	—	—	—	—	—
No Answer	14	48.3	9	32.1	23	40.4	—

Nature and Extent of Knowledge

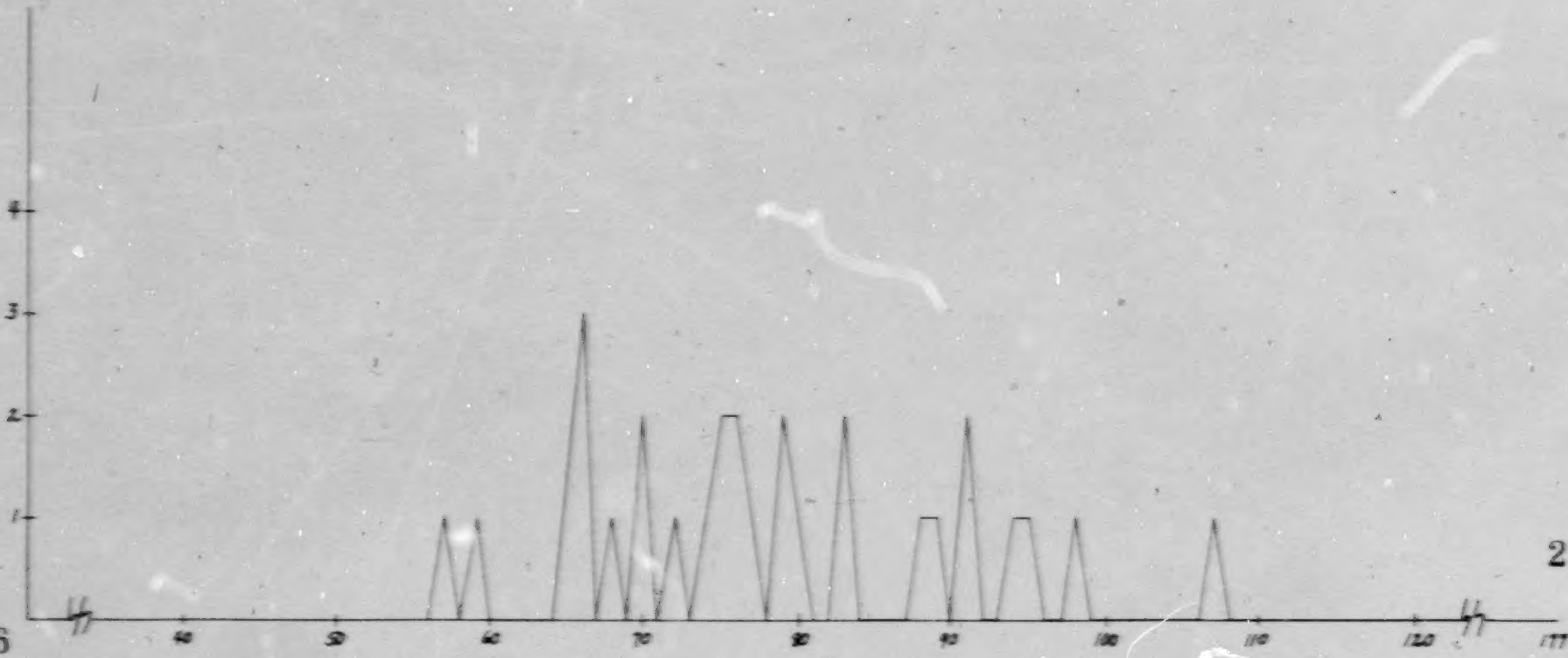
Total Scores on the Criterion-Referenced Test and Interview Items

The distribution of scores for the adult sample is presented on the following page. With a possible score of 177, the scores were very low. Scores for the general adult sample ranted from 57 to 107. Scores for the parents of children under 3 ranged from 77 to 117; as shown by the table below, this group did significantly better overall.

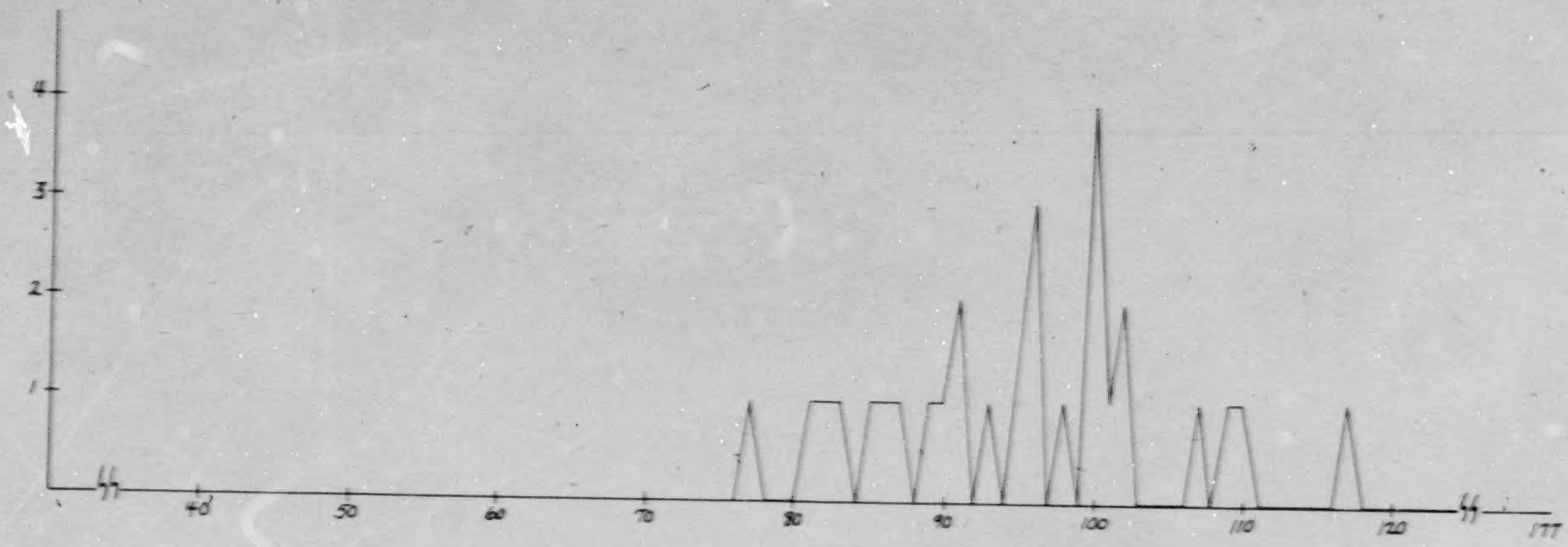
Boston - General Adults - 1976

Total Test Score

N = 29



Boston - Parents of Children Under Age 3 - 1976
Total Test Score
N = 28



	Mean*	Standard Deviation
General Adult Sample	78.2	12.1
Parents of Children Under 3	95.1	9.6

*A t test on the raw scores resulted in rejection of the H^o at level $\alpha = .05$.

The recoded scores also revealed significant differences. Over 78% of the parents of young children fell in the two upper categories, while 72% of the general adult sample fell in the two lower categories.

Recoded Scores*

Group	N	Low (0-79)	Low Average (80-86)	High Average (87-93)	High (94 & over)
General Adult Sample	29	62.1%	10.3%	13.8%	13.8%
Parents of Children Under 3	28	3.6%	17.9%	21.4%	57.1%

*A chi-square test on the raw scores resulted in rejection of the H^o at level $\alpha = .05$.

Domains and Related Subscores

The following table presents the average percent correct for each subscore within each domain. There is a fairly wide range of subscores within each domain for each group of adults indicating that some types of information were fairly well known while several others were not understood well.

DOMAINS AND RELATED SUBSCORES

	Total Possible Score	Average % Correct	
		General Adults	Parents of Children under 3
ALL ITEMS*	177	44	54
Type of Knowledge			
Behaviors to Minimize Harm	14	68	72
Preventive Behaviors*	35	49	57
General Awareness*	65	44	55
Facts and Concepts*	33	35	47
Type of Burn			
Caustic*	1	72	39
Scald*	14	53	63
Electrical*	24	49	59
Smoke	6	45	55
Flame*	78	44	53
Chemical*	5	33	47
Type of Product			
Matches/Smoking Materials	2	69	80
House Fires*	4	63	75
Space Heaters	9	61	71
Ovens/Ranges*	10	58	66
Flammable Fabrics*	22	50	63
Electrical Sources*	20	44	54
Flammable Liquids*	53	40	46

*A t test on raw scores resulted in rejection of the H° at level $\alpha = .05$.

Except for caustic burns, the rank of the subscores within each domain is identical for both groups. Within the type of knowledge domain, both groups did best on information related to minimizing harm once a fire or burn has occurred. Knowledge about behaviors to prevent fires or burns ranked second; awareness of causes and consequences of burn injuries ranked third; and understanding of underlying facts and concepts was lowest.

An analysis of subscores related to type of burn revealed an interesting paradox: Knowledge of caustic burns ranked highest for the general adult sample (72%) and lowest (39%) for parents of young children. This finding is particularly disturbing since young children are especially susceptible to such burns.

In the type of product domain, knowledge regarding matches and smoking materials ranked highest, followed by knowledge of house fires, space heaters, ovens and ranges, and flammable fabrics. Adults exhibited less knowledge about electrical sources and flammable liquids.

A comparison of subscores for the two groups revealed significant differences on thirteen out of the seventeen subscores. For each item except caustic burns, the parents of young children scored higher.

Individual Items

In analyzing individual items, the responses of both groups were combined. If an item fell into a different category for each group, the differences are highlighted. As with the adolescent sample, the criteria for the categories are: low, less than 45% correct; medium, between 45 and 65% correct; and high, more than 65% correct.

The items for the adult sample are very evenly divided among the high, medium, and low categories, and none are low for knowledge of preventive behaviors and behaviors to minimize harm once a fire or burn is in progress. A closer look at individual items in the low category reveals that adults do not recognize their odds of being in a serious fire or the long-term recovery often associated with severe burn injuries.

Other major deficits involve flammable liquids, fabrics, and electrical sources. With respect to flammable liquids, adults do not know that gas vapors are heavier than air, nor are they aware of the dangers of storing an aerosol can next to the stove. In terms of fabrics, items in the low group indicate lack of knowledge concerning the burning speed of common fabrics, the proper maintenance procedures for flame-resistant ones, and situations causing fabric ignition, such as storing goodies above the stove, running an extension cord under the rug, and using a fireplace without a screen.

A critical deficit for all people, but especially parents of toddlers, is the use of extension joints. A frequent cause of burns to young children is sucking on extension joints or poking things into them. Less than 5% of all adults are aware of this hazard.

Facts and Concepts

For all adults, including parents of toddlers, knowledge of facts and concepts ranked lowest among the four knowledge domains. As shown in the following table, items related to this area were evenly distributed among the three categories. Adults were somewhat more knowledgeable in this area than adolescents, for whom most of the same items fell in the low group.

TYPE OF KNOWLEDGE—UNDERLYING FACTS AND CONCEPTS

Question Number Inter-view	 Criterion Reference	Objectives	Type of Burn	Type of Product
HIGH				
	8	Deduce cause-effect principles of combustion.	Flame	Ovens/Ranges
	5	Identify some common flammable substances.	Flame	Flammable Liquid
	34	Recognize properties of a flammable liquid (gas vapors travel).	Flame	Flammable Liquid
	28(67)	Recognize current federal regulation of flame and smolder resistance in consumer products (baby's sleepwear).	Flame	Flammable Fabric
	11(34)	Recognize causes of possible electrical shock or burns from electric appliance cords (live electricity).	Electrical	Electrical Sources/ Appliance Cords
MEDIUM				
16a		Given a situation, deduce the relationship between flammable vapors and an ignition source in an explosion.	Flame	Flammable Liquid
18(3)	19	Recognize definition of flame resistant fabrics.	Flame	Flammable Fabric
	28(68)	Recognize current federal regulations of flame and smolder resistance in consumer products (baby's mattress).	Flame	Flammable Fabric
	11(35) 11(37)	Recognize causes of possible electrical shock or burns from electric appliance cords (water conducts, grounding).	Electrical	Electrical Sources/ Appliance Cords
18(4)	22	Recognize the function of fuses in preventing electrical fires.	Electrical	Electrical Sources
	24	Identify correct amperage of most common household fuses.	Electrical	Electrical Sources
	6	Identify some common caustic substances.	Caustic	
LOW				
	20	Recognize properties of flammable liquid (heavier than air and gather in low places).	Flame	Flammable Liquid
	15	Recognize correct maintenance of flame resistant fabrics.	Flame	Flammable Fabric
18(2)	16	Distinguish cause of loss of flame resistancy in improper washing of flame resistant fabrics.	Flame	Flammable Fabric
	28(69)	Recognize current federal regulations of flame and smolder resistance in consumer products (wall-to-wall carpeting).	Flame	Flammable Fabric
	20	Identify relative burning speed of common fabrics.	Flame	Flammable Fabric

The low items (less than 45% correct) which revealed deficiencies and misconceptions dealt almost entirely with flame resistancy and fabric ignition. When asked to select a clothing label bearing the correct washing instructions for flame-resistant fabrics, only a third of the sample could identify the critical procedures: "not to use bleaches, softeners, soap, or nonphosphate detergents." As many as 40% checked "use only nonphosphate detergent," definitely the wrong type of cleanser. (Soap and other nonphosphate detergents leave a flammable fatty residue which coats the surface of a flame-retardant garment, rendering the treatment ineffective.) In response to another question, 61% checked that a "harsh phosphate detergent will cause a fabric to lose its flame-resistant quality," completely untrue. Only 9% thought that "mild soapy water" would have that result, when in fact soap, like a nonphosphate detergent, makes a flame-resistant fabric highly flammable.

Although parents of young children knew that "flame-resistant" means a garment will "stop burning when the flame is removed," at least a third of the general adult sample checked that "it will not catch fire."

Ninety percent of all adults knew that baby sleepwear is required by law to be flame resistant, but only 56% knew that baby mattresses must also be treated. Only 2% of all adults knew that legislation had also been passed requiring all wall-to-wall carpeting to be flame or smolder resistant.

Adults were not aware of the relative burning speed (from quickest to slowest) of the following fabrics: cotton, nylon, wool, fiberglass. More than half believed nylon burns the fastest, while only 28% thought cotton does. Although wool, like most animal fibers, is relatively slow burning, only 38% correctly checked it as third slowest.

Although most adults (88%) realized that gas vapors can leak out of an uncapped container and be ignited by a distant flame, only 18% knew that gas vapors are heavier than air and gather in low places. Thirty percent checked that they are "lighter than air and rise to the ceiling," while 40% did not know.

As noted, recognition of common caustic substances--those which cause tissue damage if swallowed--fell into the high group for adults in general, but into the low group for parents of children under 3, a serious deficiency.

Items answered moderately well dealt with concepts related to electricity in the use of fuses and appliance cords and to flammability of liquids. The following situation was presented:

> Mrs. Smith was hurrying to make a pot of morning coffee. She plugged one end of the electric pot into the wall receptacle, filled the pot with water, and went to plug the female end of the appliance cord into the pot.

Participants were asked to complete the sentence, "Mrs. Smith is risking an electrical shock or burn because ______." About half knew that water conducts electricity, and that live electricity can "easily ground itself through the body." For the same question, knowledge that "the female end of the cord carries live electricity," fell into the high category (mentioned by 74% of the sample).

Slightly more than half (58%) of the sample knew to use *only* the size fuse which the household requires. However, 16% said it would be okay to use any fuse, "as long as the size of the fuse did not exceed the recommended size by four units"--a practice very likely to produce a fire--and 21% did not know.

Again, about half knew that the electrical rating of most fuses for common house circuits is 15 or 20 amps; 40% did not know the answer.

> Carolyn was using gasoline to remove tar which her husband had tracked in on the basement floor. When the gas water heater came on (10 feet away from her, on the other side of the room), the room burst into flame.

When asked the cause of ignition in the situation above, half of the sample answered correctly. Most said that the pilot light flame ignited the gasoline vapors. For some reason, parents of children under 3 answered this question much better than the other group. Other correct responses included that only the gas vapors are the cause or that the general heat in the room is responsible.

Adults did very well in recognizing some common flammable liquids (e.g., airplane glue, charcoal starter, nail polish, lighter fluid), and also in showing knowledge of the principles of combustion. When asked what would happen "if a grease fire broke out in your oven and you closed the door," 84% indicated that the result would be, "control the fire by reducing the oxygen." Only about 11% said it would "spread the fire by increasing the heat."

General Awareness of Causes and Consequences

General awareness ranked third among the four groups. As shown in the following table, the items were divided evenly among the high, medium, and low categories.

TYPE OF KNOWLEDGE—GENERAL AWARENESS

Question Number				
Interview	Criterion Referenced	Objectives	Type of Burn	Type of Product
HIGH				
22		Distinguish between situations which may cause harm due to using flammable liquids near open flame or heat source in unventilated areas and those which will not.	Flame	Flammable Liquid
	30	Predict results of pouring a flammable liquid on an ignition source.	Flame	Flammable Liquid
	25	Recognize common household devices for preventing electrical fires or burns.	Electrical	Electrical
	33	Recognize risks of using electric space heaters.	Electrical	Space Heater
	35(22)	Deduce the cause of death from using gas space heaters in closed, unvented areas (carbon monoxide).		Space Heater
17		Recognize correct placement of cooking pots on a burner to prevent scalds.	Scald	Ovens/Ranges
14b		Given a kitchen scene, identify common situations which may cause a scald and explain.	Scald	
MEDIUM				
14d		Identify burn risks associated with storage of matches above the stove.	Flame	Matches/Smoking Mat.
	17	Acquire knowledge of the swiftness with which common cotton clothing will burn.	Flame	Flammable Fabric
	18	Acquire knowledge of increased burn severity when flammable fabrics are involved.	Flame	Flammable Fabric
	7	Given a situation, deduce the cause of death from smoke inhalation as a result of bringing a charcoal grill in a closed, unvented area.	Smoke	
	35(21)	Deduce that using an unvented gas space heater in a closed area could be a cause of death.		Space Heater
LOW				
	1	Recognize their chances of being in a fire (serious enough to call the fire department).	Flame	
21		Recognize and explain that location of controls may be a risk for young children or people cooking who must reach across burners to turn them off or on.	Flame	Ovens/Ranges
14c		Explain burn risks associated with storing aerosol cans near open flame.	Flame	Flammable Liquid
14c		Explain burn risks associated with storing goodies above the stove.	Flame	Flammable Fabric
23		Identify fabric ignition as a risk of using unscreened fireplace.	Flame	Flammable Fabric
23		Explain why running an extension cord under a rug is hazardous.	Flame	Flammable Fabric
23		Recognize that extension joints may be a source of burn to young children who may suck or poke into them.	Electrical	Electrical Sources/ Extension Cords
	2 3 4	Recognize the prolonged recovery period and permanent deformity as caused by severe burn injuries.	Chemical	Flammable Liquid

A majority of the sample were unaware of their own vulnerability in a fire. Less than half (44%) recognized that their "chances of being in a fire serious enough to call the fire department" are more than one in ten. Others said one in 100 (21%) or less (22.8%), or checked "don't know."

Adults were unaware of the actual amount of hospitalization required for the treatment of severe burns (third-degree burns over 50% of the body, including face and hands) and of the period of time over which treatment is spread. Just over one-third (37%) recognized that such burns would require 33 weeks of hospitalization during the two years immediately after the burn. Unlike the adolescents, more adults overestimated the hospitalization period (seventy weeks, 33%) than underestimated it (eight weeks, 7%). Apparently, this sample realized that severe burn injuries require extensive hospitalization.

Just under one-third (32%) knew that a child who sustains such severe burns would require treatment until age 18, including periodic hospitalization for reconstructive surgery. The other two-thirds either indicated that the child would finish treatment by age 14 (age 10, 3.5%; age 12, 14%; age 14, 16%) or said they didn't know (33%). Parents of young children were twice as likely (43%) as other adults (21%) to predict that a child burned at age 7 would complete treatment at age 18.

None of the adults thought that the scars from such an injury would be "hardly noticeable" or would "fade by the time the child is 10 or 11." But 56% thought they could "be mostly eliminated by plastic surgery." Only 37% realized that a child would be permanently deformed.

When asked to choose which of three stove models they would buy, the largest percentage chose the model with control dials in the back. When asked to give a reason, most indicated that the controls were away from children. Nearly one-third (31%) of the general adult sample chose a stove with control dials on the front, a position particularly dangerous to children, but none of the other group chose such a stove. Adults who did choose a stove with front controls said, "You don't have to reach across the burners to get at the controls." Less than half chose a stove with controls on the side, a position that reduces both hazards. Parents of young children, however, chose this model twice as often as other adults.

In another question respondents were given a kitchen scene and asked to identify the burn hazards. Less than one-quarter (23%) cited the cookies stored over the stove and explained that they might tempt children to climb on the stove or cause an adult to get burned while reaching for them. About 40% identified the aerosol can as a risk because it can burn or explode near flame or heat.

Given a living room scene to analyze, most people simply said that the fireplace should have a screen. Less than 30% supplied the reason that the sparks could ignite the upholstered chair or the rug. Most respondents knew that extension cords should not be run under rugs, but few supplied the reason that the cord can fray, overheat, and ignite the rug. Less than 5% of all adults selected the extension cord joints as a major cause of burns to young children, a glaring deficiency.

Items which fell in the medium category pertained to flammable fabrics, indoor use of charcoal grills and gas space heaters, and storage of matches. For three of the six items there were large discrepancies between the two groups.

When asked, "What could result from storing matches in the cupboard above the stove?" 68% of the parents of young children said that the matches could ignite from the heat of the stove. Only 52% of the general adult population gave that answer. Both groups did poorly in recognizing the other possible hazards of storing matches over the stove. Only 5% said that children might be tempted to climb on the stove or an adult might get burned while reaching for them.

A majority of the adults knew that a floor-length cotton nightgown (not flame resistant) would burn from hem to neckline in fifteen to thirty seconds. Again, more parents of children under 3 (68%) than other adults (55%) were aware of this. More than half (54%) of all adults realized that a boy wearing long cotton trousers would be burned more severely than one wearing shorts, if sparks landed on each boy's leg.

Told about a woman who died while cooking on a charcoal grill in an enclosed shed, adults were asked to identify possible causes of death. Of the parents of young children, 50% checked "lack of oxygen" and "smoke inhalation" and 61% checked "carbon monoxide poisoning" (both correct answers). The other group performed less well: 41% checked "lack of oxygen"; 38%, "smoke inhalation"; and 45%, "carbon monoxide poisoning." Consistent results are obtained for a similar question about the cause of death from using a gas space heater indoors. Of the parents of children under 3, 68% checked "the space heater was unvented"; 79%, "carbon monoxide"; and 75%, "the windows were shut." The general adult sample did less well: 59% checked "the space heater was unvented" and "carbon monoxide," while 48% said "the windows were shut."

Items in the high category covered a wide variety of topics. Nearly everyone (97%) recognized that pouring charcoal lighter fluid on a lighted barbecue can cause a flashback of the flame to the can. When given a variety of situations involving flammable liquids and asked to distinguish those that could cause burns, all items fell into the high group.

All adults did well on two questions about electricity. A large majority (86%) selected fuses and outlet caps, rather than extension joints and cords, as devices for preventing electrical fires and burns. When asked to identify the hazards of an electric space heater in the bathroom, a majority gave the correct answers. Two of the three correct answers--contact burns and clothing ignition--were identified by more parents of young children (89%, contact burns; 79%, clothing ignition) than by the general adult sample (72%, contact burns; 55%, clothing ignition). Electrocution was recognized as a major hazard by 93% of both groups.

The final items which fell in the high category involved scalds. More parents of young children (86%) than the general adult sample (62%) identified a pot cooking safely on a burner. Although most adults realized that hot coffee could cause burns, 80% of the parents of young children knew that tablecloths were hazardous to young children who might pull on them and spill hot liquid on themselves, compared to about half as many adults from the general sample (43%).

Preventive Behaviors

Adults' knowledge of preventive behaviors ranked second among the four knowledge domains. Again, the items were divided evenly among the high, medium, and low categories.

TYPE OF KNOWLEDGE—PREVENTIVE BEHAVIORS

Question Number Inter-view	 Criterion Referenced	Objectives	Type of Burn	Type of Product
HIGH		Recognize that to prevent burns one should:		
18(10)	29	Plan an outside meeting place as part of a fire drill.	Flame	House Fire
18(6)	32	Not pour gasoline or charcoal starter on a slowly burning fire.	Flame	Flammable Liquid
	12	Turn off gas, vent room, and wait before relighting gas burner.	Flame	Flammable Liquid
	39	Store oily rags in covered metal container.		Flammable Liquid
	36(20)	Locate a space heater three feet away from any object.		Space Heaters
	26(61)	Have plug fit securely in extension cord.	Electrical	Electrical Sources/ Appliance Cords
MEDIUM		Recognize that to prevent burns one should:		
	21(50)	Not store extra gasoline.	Flame	Flammable Liquid
	19	Store gasoline in a tightly capped metal container with a pressure-release valve.	Flame	Flammable Liquid
	21(48)	Not pour flammable liquid into a hot machine.	Flame	Flammable Liquid
	(49)	Empty gasoline out of power equipment after each use.	Flame	Flammable Liquid
16b		Not use gasoline as a cleaner in any area of the house.	Flame	Flammable Liquid
14a		Not use a towel as a pot holder.	Flame	Flammable Fabric
14a		Wear tight-fitting, flame-resistant, or short-sleeved clothing when cooking at the stove.	Flame	Flammable Fabric
	26(62)	Buy extension cords that allow for only one appliance.	Electrical	Electrical Sources/ Appliance Cords
	(63)	Not repair frayed cords with electric tape.	Electrical	
	(64)	Tape a semi-permanent plug into place.	Electrical	
	36(29)	Use a screen with a space heater.		Space Heaters
LOW				
—		—	—	—

The most glaring deficiencies involved extension cords, power equipment, and clothing worn when working near the stove. Although most adults would make sure a "plug fits securely into an extension joint" (72%), and "buy an extension cord that allows for only one appliance" (54%), only 12% would tape a semipermanent plug into place. More critical is the fact that a third of the sample would repair a frayed cord with electrical tape, a very unsafe practice.

Concerning flammable liquids and their use with power equipment, more than half (56%) saw "storing extra gasoline" as a disadvantage, while less than a third (31%) viewed having to "wait until the equipment is cool before refueling" as one.

In the kitchen scene, most (70%) knew that a towel should not be used as a potholder, but less than 20% stated the preventive behavior of rolling up long sleeves or wearing tight-fitting clothing when cooking.

Preventive behaviors that were answered moderately well centered around the location of a smoke detector and proper cans for storing gasoline. About half of the adults (54%) correctly said that a smoke detector should be located in the bedroom hallway, but another 40% thought the best place was at the base of the stairs to the second floor. While this location would detect the smoke at an early stage, people upstairs would have difficulty hearing the warning alarm. Since smoke rises, the bedroom hallway is the best location.

In selecting appropriate gas cans, half chose the can with a tight-fitting lid and a pressure-release valve. A third chose a plain, tightly capped metal can with no valve. Less than 10% each chose the plastic or glass container or the metal can with a long pouring spout.

> Carolyn was using gasoline to remove tar which her husband had tracked in on the basement floor. When the gas water heater came on (10 feet away from her, on the other side of the room), the room burst into flame.

When asked how Carolyn could have prevented the accident above, 48% of the general sample and 71% of the other group said, "Don't use gasoline." Other suggestions, given by about a third of the adults were "open windows to ventilate vapors" and "turn off the hot water heater." Only 10% of both groups recommended using a "nonflammable cleaner."

A variety of items were answered very well. Ninety-one percent checked that "if your gas burner won't light, a good thing to do is turn the gas off, open the window, and wait a few minutes." Most people knew that oily rags should be stored in "covered metal containers" (79%) and that charcoal starter or gasoline should not be used to revive a slowly burning fire. Placing a space heater "three feet away from any object" was another well-known behavior. Most adults knew that a critical part of home fire drills is arranging "an outside meeting place after you all escape." However, 11% thought that "how you can reenter the house to rescue someone" is the most important thing to consider.

Behaviors to Minimize Harm

Knowledge of behaviors to minimize harm ranked first. All but one item fell into the high group, indicating that the adult group is very knowledgeable on this topic.

The only question in the low or medium group involved the best first action in the event of a scald. About two-thirds of the adults said, "remove your wet clothes," then "apply cold water," but about 20% reversed the order. Only 7% of the adults would put lotion or butter on the burn.

TYPE OF KNOWLEDGE—BEHAVIORS TO MINIMIZE HARM

Question Number				
Interview	Criterion Referenced	Objectives	Type of Burn	Type of Product
HIGH		Recognize that to prevent harm once a burn or fire is in progress, one should:		
	9	Place a lid on a grease fire in a pan.	Flame	House Fire
	10	First pull out the plug and throw water on a fire in an electrical appliance.	Electrical	Space Heaters
18(1)	13	First remove clothing which has had a hot liquid spilled on it.	Scald	
	27	Identify proper procedures to follow during a fire (if caught in a fire on the fourth floor stuff the door crack, hang a piece of clothing from the window, and wait).	Smoke	House Fire
18(5)	31	Drop and roll to extinguish burning clothing.	Flame	Flammable Fabric
	37	Immediately remove source of heat and apply cold water to a burn.		
	38	Crawl through smoke.	Smoke	House Fire
MEDIUM		Recognize that to prevent harm once a burner fire is in progress one should:		
	14	Apply cold water to a scald after wet clothing has been removed.	Scald	
LOW	—	—	—	—

Most adults (86%) knew about crawling through smoke in a house fire; only 5% each would either run fast or walk quickly. The following situation was presented:

> A person on the fourth floor of an apartment building wakes up in the middle of the night and smells smoke. He discovers that his shut bedroom door is ~~hot.~~ He should:

Most (72%) checked the "best" response: "stuff the door crack, hang a piece of clothing from the window, and wait." Twenty-one percent would "open the window and jump to some bushes," which from the fourth floor might not be the "best" response.

The item on which adults did least well involved extinguishing a grease fire in a pan. Only 66% would place a lid on it, while 58% would use "baking powder" and 28% "flour." Both baking powder and flour could explode if used in this way.

Is Knowledge Related to Selected Sample Characteristics?

As discussed earlier in the report, there were significant differences on the criterion-referenced test on overall scores and subscores between the general adult group and the parents of children under 3. Therefore, the relationship of the sample characteristics to knowledge is presented separately for each group.

As shown in the following series of tables, no statistically significant relationship occurred between knowledge and age, sex, socioeconomic status or income level for either group. The relationship between knowledge and fire/burn safety information or burn history is not shown, because almost everyone had received fire/burn safety information and had never been burned.

In many cases, the size of the subsamples is very small. Thus, interpretation of the data must be approached with caution.

Knowledge by Age

General Adult Group

Overall Scores by Age*

Age	N	Mean	Standard Deviation
General Adults			
15-24	9	75.8	14.6
25-34	10	78.1	11.5
35-44	6	81.8	11.1
45-54	4	78.8	12.6

*An ANOVA test on raw scores resulted in failure to reject the H^{o} at level $\alpha = .05$.

Parents of Children Under 3

Overall Scores by Age*

Age	N	Mean	Standard Deviation
15-24	3	95.7	0.6
25-34	20	97.2	10.2
35-44	5	86.6	3.5

*An ANOVA test on raw scores resulted in failure to reject the H^{O} at level $\alpha = .05$.

Knowledge by Sex

General Adult Group

Recoded Scores by Sex*

Sex	N	Low (0-79)	Low Average (80-86)	High Average (87-93)	High (94 & over)
Male	12	58.3%	16.7%	16.7%	8.3%
Female	17	64.7%	5.9%	11.8%	17.6%

*A chi-square test on raw scores resulted in failure to reject the H^{O} at level $\alpha = .05$.

KNOWLEDGE BY SEX
(expressed in average percent correct)

	Male	Female
ALL ITEMS	43	45
Type of Knowledge		
Facts and Concepts	34	36
General Awareness	44	44
Preventive Behaviors	49	48
Behaviors to Minimize Harm	64	71
Type of Burn		
Caustic	75	71
Scald	49	56
Electrical	52	46
Smoke	47	44
Flame	43	44
Chemical	30	35
Type of Product		
Matches/Smoking Materials*	50	82
House Fires	60	65
Space Heaters	68	56
Ovens/Ranges	54	61
Flammable Fabrics	46	53
Electrical Sources	47	42
Flammable Liquids	41	39

*A t test on raw scores resulted in rejection of the H^o at level $\alpha = .05$.

Parents of Children Under 3

Overall Scores by Sex*

Sex	N	Mean	Standard Deviation
Parents of Toddlers			
Male	2	94.5	10.6
Female	25	94.6	9.4

*A t test on raw scores resulted in failure to reject the H^O at level $\alpha = .05$.

Recoded Scores by Sex*

Sex	N	Low (0-79)	Low Average (80-86)	High Average (87-93)	High (94 & over)
Male	2	0.0%	0.0%	50.0%	50.0%
Female	25	4.0%	20.0%	20.0%	56.0%

*A chi-square test on raw scores resulted in failure to reject the H^0 at level $\alpha = .05$.

KNOWLEDGE BY SEX*
(expressed in average percent correct)

	Male	Female
ALL ITEMS	53	53
Type of Knowledge		
Facts and Concepts	48	47
General Awareness	55	55
Preventive Behaviors	61	56
Behaviors to Minimize Harm	57	73
Type of Burn		
Caustic	50	40
Scald	54	62
Electrical	52	59
Smoke	67	53
Flame	53	53
Chemical	50	46
Type of Product		
Matches/Smoking Materials	100	80
House Fires	88	73
Space Heaters	61	71
Ovens/Ranges	60	60
Flammable Fabrics	64	63
Electrical Sources	50	54
Flammable Liquids	48	46

*A t test on raw scores resulted in failure to reject the H° at level $\alpha = .05$ for each of the subscores.

Knowledge by Socioeconomic Status

General Adult Group

Overall Scores by Socioeconomic Status*

SES	N	Mean	Standard Deviation
1	5	85.2	17.7
2	4	71.3	6.3
3	7	83.6	8.8
4	5	72.6	12.7
5	1	75.0	0.0

*An ANOVA test of raw scores resulted in failure to reject the H^O at level $\alpha = .05$.

Parents of Children Under 3

Overall Scores by Socioeconomic Status*

SES	N	Mean	Standard Deviation
1	5	101.0	12.6
2	14	93.4	10.0
3	4	97.8	3.1
4	4	94.5	6.0
5	0	—	—

*An ANOVA test on raw scores resulted in failure to reject the H^O at level $\alpha = .05$.

Knowledge by Income Level

General Adult Group

Overall Scores by Income Level*

Income	N	Mean	Standard Deviation
Under $5,000	5	69.0	10.9
$5-10,000	6	83.2	12.0
$10-15,000	8	79.6	13.1
$15-20,000	3	82.7	14.4
$20-25,000	2	80.0	19.8
Over $25,000	5	76.0	7.3

*An ANOVA test on raw scores resulted in failure to reject the H^O at level $\alpha = .05$.

Parents of Children Under 3

Overall Scores by Income Level*

Income	N	Mean	Standard Deviation
Under $5,000	2	89.5	9.2
$5-10,000	1	98.0	0.0
$10-15,000	11	96.5	8.2
$15-20,000	4	95.5	7.3
$20-25,000	4	96.8	8.7
Over $25,000	5	91.4	16.8

*An ANOVA test on raw scores resulted in failure to reject the H^0 at level $\alpha = .05$.

Behaviors and Practices of Adult Populations

A number of questions asked during the interviews focused on adult practices and behaviors. We found that generally what people reported they did was related to what they know: the more people knew about burn and fire safety, the less they were apt to ignore good practice in their behaviors; if they had less knowledge, they were more likely to engage in potentially dangerous behaviors that could result in burn injury. For example, adults scored poorly on identifying the risk of fabric ignition when using an unscreened fireplace. At least 25% of the parents of children under 3 and 50% of the general adult sample with fireplaces actually used them to toast marshmallows or broil steaks, and 30% of the general adult sample used them to burn charcoal or incinerate trash.

Adults scored poorly or in the medium range when asked about the properties of flammable liquids, proper storage of gasoline, and precautions associated with emptying gas after using gas-powered equipment. Eighty percent reported that they store gasoline, and less than 30% said they actually remove the gasoline from power equipment after using it. Most adults (over 65%) did well at predicting the results of pouring flammable liquids on an ignition source; we still find 11% of the parents of children under 3 said they used gasoline to ignite or increase the fire in their fireplaces. In addition, most adults (over 65%) knew they should turn off the gas, vent the room, and wait before relighting a gas burner, yet one-third of those with gas stoves reported having pilot lights that were not in working order.

About one-third of all adults dress improperly when cooking: wearing loose-fitting clothes, clothes with large sleeves, or long bows.

The only area of knowledge that seemed unrelated to actual practices was fire escape drills. Almost all adults realized that an outside meeting place is the most important thing to consider after escaping from the house. But less than half reported having a fire escape plan and, more importantly, most who had a plan had never practiced it.

The following analysis presents adults' reports of behavior and indicates how the two subgroups compare. The areas discussed are flammable liquids, gas-powered equipment, ovens/ranges, space heaters, fireplaces, matches, fire-resistant fabrics, and fire escape plans and smoke detectors. For convenience, the general adult sample is referred to by the initial "G" and the parents of children under 3 are labeled "C."

Flammable Liquids

The majority of adults said they store flammable liquids (such as paint thinner, turpentine or alcohol) in their homes (C, 90%; G, 66%). Parents of young children were much more likely to store such liquids in metal containers with tight-fitting tops (C, 92%; G, 68%). The most common area for storing flammable liquids was the basement (an unsafe place if a hot water heater or furnace is also present), followed by a garage attached to the house, and a building or garage away from the house. Parents of toddlers were much more likely than the general adult group to store them in the basement (C, 76%; G, 35%).

Gas-Powered Equipment

About half of all adults reported having gas-powered equipment in their homes. Lawn mowers were most common (over 90% of all adults have one), followed by snow blowers (C, 33%; G, 40%), chain saws (C, 20%; G, 40%), portable generators (C, 0%; G, 10%), and snowmobiles (C, 0%; G, 10%). A low percentage (C, 20%; G, 30%) of adults emptied the gas tank before putting gas-powered equipment away. The majority (over 80%) said they keep extra gasoline on hand, but less than one-third stored it in the proper container. About half of the adults stored gasoline in a building or shed away from the house, and 15% stored it in the basement. Parents of children under 3 were more likely to store gasoline in a garage attached to the house (C, 33%; G, 11%), while the general adult group was more likely to store it in a garage away from the house (G, 33%; C, 17%).

Ovens/Ranges

All but 7% of the general adult sample had stoves or ranges in their homes or apartments. About three-quarters (C, 71%; G, 79%) reported that the dials turn through a progression of temperature settings before coming to full heat. About the same percentage (C, 79%; G, 72%) had controls placed so that it wasn't necessary to reach across the burners to turn them on and off. Less than half (C, 41%; G, 36%) of all adults said their stove controls were hard for children to reach.

Among adults with electric stoves, parents of young children were more likely to have signals that light up when a burner or oven is on (C, 92%; G, 57%) and to have all signals working properly (C, 77%; G, 29%). Among adults with gas ranges, more parents of young children had a pilot light for each burner and for the oven (C, 87%; G, 67%); however, less of them had all pilot lights working (C, 67%; G, 76%).

About one-third of all adults reported that they wear loose-fitting clothes or clothes with large sleeves or long bows when cooking at the stove. The general sample was more likely than parents of children under 3 to use something other than a potholder or oven mitt to remove pots from a stove (G, 33%; C, 10%).

Space Heaters

Space heaters were rare among these two sample groups. No one in the general adult group had one and only 11% of the other group did. Those who did have them did not always use them properly. They said they did not have it inspected before using it after a period of nonuse; did not keep a window or door at least partially open when using an unvented space heater; did not keep the heater three feet away from any flammables in the room; and did sometimes go to sleep with the heater in operation.

Fireplaces

Most adults (C, 68%; G, 70%) reported having a hearth (brick or stone apron) of ample size. Most said they keep a screen in front of the fireplace when it is in use (C, 74%; G, 70%); and instruct members in the family—especially young and old—about the prescribed rules for fireplace safety (C, 73%; G, 70%). About 60% of each group kept the area near the fireplace free of flammable items.

Few adults (C, 21%; G, 30%) reported having a fireplace cleaned and inspected regularly. Very few adults had had an inspection of the fireplace, its vents, and the chimney within a year (C, 11%; G, 20%); about 50% had never had an inspection or did not know the time of the last inspection. When asked if all carpets, upholstery, and other such flammables in the fireplace room were made of flame-resistant materials, very few (C, 11%; G, 10%) replied in the affirmative.

Parents of children under 3 were less likely than the other group to check the operating condition of the damper (C, 58%; G, 70%), and more likely to leave the house empty or go to bed while a fire was still burning or smoldering (C, 63%; G, 40%). They were more apt to use gasoline to ignite or increase the fire (C, 11%; G, 0%) and had a greater tendency to let children play around the fireplace area (C, 47%; G, 10%). However, they were less likely than the general adult sample to "toast marshmallows or broil steaks" in the fireplace (C, 26%; G, 50%); and never used the fireplace for burning charcoal or incinerating trash (C, 0%; G, 30%).

Matches

Most adults (C, 72%; G, 79%) said they close the cover of a matchbook before striking a match. However, over two-thirds of the general sample and over 40% of the other group said they leave matches out on tables and counters on occasion.

Flame-Resistant Fabrics

When asked if they check the tags when buying clothing to see if the clothing is flame-resistant, more than half of all adults said they did not. Parents of young children seemed more likely to make such observations (C, 46%; G, 7%). When asked if they own flame-resistant clothing, almost 80% of the parents of young children said "yes," compared to only 14% of the general adult population.

Fire Escape Plans and Smoke Detectors

Less than half of all adults interviewed reported having a fire escape plan. Fewer parents of children under 3 had such a plan (C, 29%; G, 52%). More importantly, when those who had a plan were asked when they last practiced it, most said "never" (C, 100%; G, 75%). Parents of young children were less likely than the general sample to have two escape routes for every room in the house (C, 67%; G, 80%).

Few adults had smoke detectors in their homes (C, 21%; G, 10%). Those who had no smoke detectors were asked if they ever considered installing one; 62% of the parents of children under 3 said "yes," compared to 31% of the general adult sample. When asked where is the best place to install a smoke detector, fewer of the general sample correctly checked "in the bedroom hallway" (C, 61%; G, 48%). Most others said, "at the base of the stairs to the second floor."

Fire Department Inspections

Few adults had ever requested their local fire department to inspect their homes for fire hazards (C, 7%; G, 21%). However, parents of young children were somewhat more willing to do so. When asked if they would like the interviewer to arrange for a representative of the local fire department to call and set an appointment for an inspection of their home, 36% of this group agreed, compared to only 3% of the general adult population. (In some communities this is done automatically on a yearly basis.)

Characteristics of the Adults Surveyed by Telephone

The sample surveyed by telephone consisted of 599 adults from the Boston SMSA (experimental site). The characteristics of the sample described in the table below are sex, age, income, total number of people in the household, and number of children under age 3.

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DEMOGRAPHIC CHARACTERISTICS (N=599)

	N (Total N=599)	% Total	% Respondents
Sex			
Male	291	48.6	48.6
Female	307	51.2	51.3
Not Ascertained	1	0.2	—
Age			
15-19	23	3.8	3.9
20-24	70	11.7	11.7
25-34	158	26.4	26.5
35-44	98	16.4	16.4
45-54	101	16.9	17.0
55-64	70	11.7	11.7
65 and over	76	12.7	12.8
No Answer	3	0.5	—
Income			
Under $5,000	61	10.2	13.1
$5,000-10,000	85	14.2	18.2
$10,000-15,000	114	19.0	24.5
$15,000-20,000	97	16.2	20.8
$20,000-25,000	55	9.2	11.8
Over $25,000	54	9.0	11.6
No Answer	133	22.2	—
Number in Household			
1-4	457	76.3	76.8
5-6	105	17.5	17.6
7 or more	33	5.5	5.6
No Answer	4	0.7	—
Children under 3			
Yes	81	13.5	13.5
No	517	86.3	86.5
No Answer	1	0.2	—

Men and women were represented equally in the sample. The sample was divided fairly evenly across most age ranges except there were more participants in the 25-to-34 age group than in other groups, and fewer in the 15-to-19 age group.

About 25% reported incomes up to $10,000; a third fell between $10,000 and $20,000; and about 20% were over $20,000. A large number, 22%, would not answer the question.

A large majority of the participants (76%) came from relatively small families (four persons or less), and only about 5% came from families of seven or more persons. Fourteen percent of the participants had children under the age of 3.

The burn histories of the participants are described in the following two tables. As the first table shows, approximately 10% indicated they had received burns that required medical attention. Similarly, 8% indicated that a family member had been burned seriously. Most burns had resulted from hot liquids (43%) or contact with hot objects (15%). Only 6% reported they had ever received flame burns. Electrical burns occurred least frequently (4%).

DEMOGRAPHIC CHARACTERISTICS

	N	% Total	% Respondents
Burned/Required Medical Attention:			
Self			
Yes	59	9.8	9.8
No	540	90.2	90.2
Family Member			
Yes	50	8.3	8.5
No	540	90.2	91.5
No Answer	9	1.5	—
Type of Burn			
Hot Liquid	40	6.7	43.0*
Contact	14	2.3	15.1
Flame	6	1.0	6.5
Flammable Liquid	5	0.8	5.4
Electrical Device	4	0.7	4.3
Other	24	4.0	25.8

*Percent of persons who had been burned or who had a family member burned (N=93)

The second table describes types of reported burn accidents in terms of the victim's age, the severity of the burn, treatment, and when the accident occurred. Because the number of persons in each burn-type group is small, it is not possible to generalize to the entire population.

ACCIDENT CHARACTERISTICS BY TYPE OF BURN

		Scald (N=40)		Electrical (N=4)		Flame (N=6)		Contact (N=14)		Flammable Liquid (N=5)		Other (N=24)	
		N	%	N	%	N	%	N	%	N	%	N	%
Characteristics of Accident													
Age of Victim:													
Under 5	(N=12)	9	22.5	1	25.0	—	—	1	7.1	—	—	1	4.2
5-9	(N=15)	8	20.0	—	—	1	16.7	3	21.4	—	—	3	12.5
10-19	(N=19)	9	22.5	—	—	1	16.7	4	28.6	1	40.0	4	16.7
20-64	(N=43)	12	30.0	3	75.0	4	66.7	5	35.7	3	60.0	16	66.7
65 and over	(N= 1)	—	—	—	—	—	—	1	7.1	—	—	—	—
No Answer	(N= 3)	2	5.0	—	—	—	—	—	—	1	20.0	—	—
Severity of Burn:													
Under 10% of Body	(N=57)	25	75.8*	3	75.0	5	83.3	10	71.4	3	60.0	11	64.7*
Over 10% of Body	(N=22)	8	24.2*	1	25.0	1	16.7	4	28.6	2	40.0	6	35.3*
No Answer	(N=14)	7	17.5	—	—	—	—	—	—	—	—	7	29.2
Burn Treatment:													
Hospitalized	(N=23)	7	17.5	—	—	3	60.0*	2	14.3	1	20.0	10	45.5*
Other	(N=67)	33	82.5	4	100.0	2	40.0*	12	85.7	4	80.0	12	54.5*
No Answer	(N= 3)	—	—	—	—	1	16.7	—	—	—	—	2	8.3
When Accident Happened													
Season:													
Winter	(N=20)	9	64.3*	—	—	3	60.0*	[illegible]	20.0*	2	50.0*	5	35.7*
Spring	(N= 9)	1	7.1*	1	50.0*	1	20.0*	1	20.0*	1	25.0*	4	28.6*
Summer	(N=11)	3	21.4*	1	50.0*	—	—	3	60.0*	1	25.0*	3	21.4*
Fall	(N= 4)	1	7.1*	—	—	1	20.0*	—	—	—	—	2	14.3*
No Answer	(N=49)	26	65.0	2	50.0	1	16.7	9	64.3	1	20.0	10	41.7
Day:													
Weekday	(N=39)	6	23.1*	2	50.0	3	75.0*	6	66.7*	1	25.0*	7	63.6*
Weekend	(N=19)	20	76.9*	2	50.0	1	25.0*	3	33.3*	3	75.0*	4	36.4*
No Answer	(N=35)	14	35.0	—	—	2	33.3	5	35.7	1	20.0	13	54.2
Time of Day:													
Morning	(N=25)	10	30.3*	1	50.0*	—	—	3	33.3*	2	50.0*	9	56.3*
Afternoon	(N=19)	8	24.2*	1	50.0*	1	20.0*	3	33.3*	1	25.0*	5	31.3*
Night	(N=25)	15	45.5*	—	—	4	80.0*	3	33.3*	1	25.0*	2	12.5*
No Answer	(N=24)	7	17.5	2	50.0	1	16.7	5	33.7	1	20.0	8	33.3

* Percent of respondents for that question.

For each of the six types of burn, the largest proportion of victims were between the ages of 20 and 64. Except among the elderly, scalds occurred most frequently in each group (under 5, 75%; 5 to 9, 53%; 10 to 19, 47%; 20 to 64, 28%). Contact burns were the only type of burn reported by the elderly.

Within each burn category, a majority of persons had had less than 10% of their bodies burned. When a larger body area was affected, flammable liquids were involved for 40% of the victims. Flame burns were the only type of burn for which a majority of victims (60%) had been hospitalized during treatment.

For each burn type except electrical, a pattern emerges as to when most such accidents seem to occur. Although a number of persons who reported scalds had forgotten when the accident occurred, most of those who did remember said the injury occurred on a weekend evening in the winter. Flame burns occurred most often on weekday evenings in the winter (January to March); contact burns on weekdays in the spring; and flammable liquid burns on weekend mornings in the winter.

DEMOGRAPHIC CHARACTERISTICS

Fire Safety Information	N	% Total	% Respondents
No	254	42.4	42.4
Yes	345	57.6	57.6
Fire Department	103	17.2	30.0*
School	61	10.2	17.7
Literature	26	4.3	7.5
Work	21	3.5	6.1
Insurance Co.	16	2.7	4.6
Military	10	1.7	2.9
Scouting	5	0.8	1.5
TV-Dick Van Dyke	5	0.8	1.5
TV-Not Dick Van Dyke	4	0.7	1.2
Movie	1	0.2	0.3
Other	93	15.5	27.0

*Percent of persons who had received fire safety information (N=345)

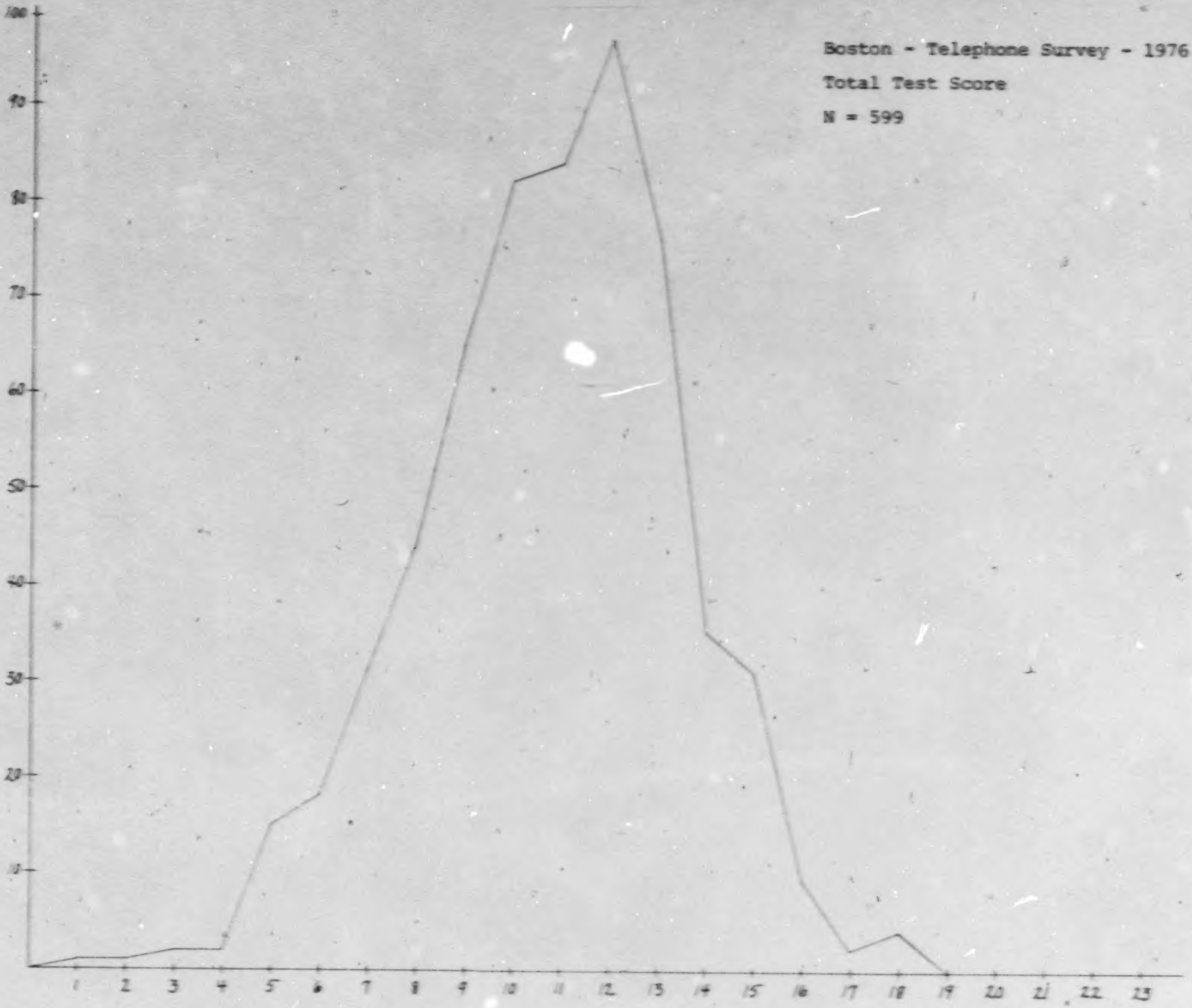
The table above indicates that 58% of the sample had received fire safety information. The source mentioned most frequently was the fire department (30%), followed by schools (18%). No other source was mentioned by more than 10% of the participants.

Nature and Extent of Knowledge

Total Scores on the Criterion-Referenced Test

The distribution of scores for the telephone survey is presented on the following page. With a possible score of 23 points, scores tend to be normally distributed from 1 to 18. The mean is 10.8 with a standard deviation of 2.7.

An examination of the recoded scores indicates that the majority of persons (73%) fell in the two average categories. The remainder are twice as likely to fall in the low category (19%) than in the high (8%).



Boston - Telephone Survey - 1976
Total Test Score
N = 599

Recoded Scores

N	Low (0-8)	Low Average (9-11)	High Average (12-14)	High (15 & over)
599	19.0%	38.6%	34.7%	7.7%

Domains and Related Subscores

The following table presents the average percent correct for each subscore within each domain for the telephone sample. The information presented here suggests that these adults need more information in most areas of fire and burn safety. On only one of the subscores--knowledge of behaviors to minimize harm--is the average percent correct above 50%. For electrical burns the average percent is only 5%.

Since the purpose of the telephone survey was to assess overall knowledge, few questions were directed to specific products, and these subscores were not used as a source for that information.

DOMAINS AND RELATED SUBSCORES

	Total Possible Score	Average % Correct
ALL ITEMS	23	47
Type of Knowledge		
Behaviors to Minimize Harm	6	56
General Awareness	7	47
Facts and Concepts	4	45
Preventive Behaviors	5	39
Type of Burn		
Flame	12	43
Scald	6	40
Contact	3	18
Electrical	5	5

Looking first at scores within the type of knowledge domain, the adults reached by telephone appeared to know the most about behaviors for minimizing harm (an average of 56% correct). Awareness of the causes and consequences of fire and burn injuries was about the same as knowledge of underlying facts and concepts (47% and 45%, respectively). Items pertaining to preventive behaviors ranked lowest (39%). This finding is particularly interesting, since all questions within this domain asked about the individual's actual behaviors and home practices rather than his or her knowledge of the correct actions.

An analysis of subscores related to type of burn revealed that adults knew most about flame burns (43%) and scalds (40%), and had least knowledge about contact burns (18%) and electrical burns (5%).

Individual Items

Using the criteria established previously for the adolescent sample (over 65% correct = high; 45 to 65% = medium; and less than 45% = low), most criterion reference items (62%) in the telephone survey fell into the low category.

Generally, adults were unaware of certain risks to themselves or to other age groups. They did not recognize that:

- Scalds are the most common source of burns to adults and children under 3 and that they can be just as serious as flame burns;
- Toddlers usually incur electrical burns from chewing on electrical cords;
- Cotton and other lightweight fabrics catch fire most easily;
- High tension wires are never insulated (a particular hazard for adolescents).

Adults also indicated that they do not practice preventive measures for avoiding fires or burn injuries. They do not:

- Take all necessary safety precautions for storing flammable liquids;
- Buy flame-resistant clothing;
- Have home fire drills;
- Own fire extinguishers or smoke detectors.

Other items that were correctly answered by less than 45% of the survey participants included choosing the correct definition of a flame-resistant fabric, and telling the first thing to do in treating a scald.

The survey participants did moderately well at recognizing that tap water can cause severe burns and that matches and lighters are the most common cause of burns to children ages 4 to 9. A moderate number knew how to put out a grease fire and how to treat a severe burn. While a moderate number of families have action plans in case of fire, fewer had actually practiced them.

Most participants (over 65%) recognized that: one should never leave an infant alone in the house; one should "drop and roll" to extinguish burning clothing; vapors from a flammable liquid can spread and be ignited by a distant flame.

Facts and Concepts

Knowledge of facts and concepts ranked third among the knowledge domains. Only four of the telephone survey items fell in the facts and concepts domain and of these, three fell in the low group.

TYPE OF KNOWLEDGE—UNDERLYING FACTS AND CONCEPTS

Question Number	Objectives	Type of Burn	Type of Product
HIGH			
19	Recognize properties of a flammable liquid (fumes can travel and be ignited by a distant flame).	Flame	
MEDIUM			
—	—	—	—
LOW			
13	Recognize definition of flame resistant fabrics.		Flammable Fabric
25	Distinguish types of clothing and fabrics that are most likely to catch fire.		Flammable Fabric
29	Recognize that overhead transmission lines are never insulated.		

Two of the three items within the low category have to do with flammable fabrics. In one question, participants were asked to choose the definition of a flame-resistant fabric from a list of several possibilities. Almost no one (1%) chose the correct answer ("one that stops burning when flame is removed"). Most persons thought that a flame-resistant fabric "resists burning" (35%) or "will not burn" (26%).

Similarly, few persons gave correct answers when asked, "What kinds of clothes and fabric do you think are most likely to catch fire?" Cotton, the fabric most likely to catch fire, was mentioned by only 22% of the participants. Nylon, which also burns quite easily, was mentioned by only 14%. Other answers included: synthetics (19%); wool (6%); polyester (3%); silky (2%); night apparel (4%); and plastics (2%).

The other item in the low category pertains to high tension wires. Participants were asked, "When, as far as you know, are high tension wires insulated?" Almost no one (6%) correctly answered "never." At least a third said "always" (34%), and 45% did not know.

The only other item in the facts and concepts domain had to do with the properties of flammable liquids. Most participants (84%) correctly agreed that "vapors from flammable liquids can flow invisibly along the ground and be ignited by a distant flame or heat source."

General Awareness

General awareness items ranked second highest overall. The questions within this knowledge domain can be grouped into four subtopics: perception of the risk from various types of accidents; perception of general fire and burn hazards; perception of burn hazards for various age groups; and perception of burn hazards themselves.

One of the first questions asked was, "Which of the following do you consider to be the greatest risk to yourself? the second greatest risk? the least risk?" The largest number of persons (48%) felt they were most likely to be injured from automobile accidents. About 20% believed the greatest risk to them was burns or fire. About equal numbers indicated automobile accidents (25%) or burns/fires (26%) as the second greatest risk to them. Most people (40%) believed boating and water accidents to be the source of least risk. Few mentioned either burns (2%) or auto accidents (3%) as the source of least risk. Other choices offered in the question were falling or tripping (most risk, 13%; least risk, 19%), gun accidents (most, 6%; least, 23%), and assault (most, 8%; least, 5%).

TYPE OF KNOWLEDGE—GENERAL AWARENESS

Question Number	Objectives	Type of Burn	Type of Product
HIGH			
17	Recognize that close supervision is necessary for protecting young children from fire or burn injuries.		
MEDIUM			
16	Recognize that water from a faucet can cause severe burns.	Scald	Hot Liquids
26	Recognize that matches and lighters are the most common cause of burns to 4-9 year old children.		
LOW			
20	Recognize that scalds are the most common type of burn for adults.	Scald	
27	Recognize that scalds are the most common type of burn for children under age 3.		
28	Recognize that electrical burns to toddlers usually result from their chewing on cords.	Electrical	Electric Cords

Participants were asked what they considered the greatest fire hazards in their homes. Most mentioned the stove (23%) and the wiring (22%). Other items mentioned were: smoking (13%), furnace (11%), electrical appliances (4%), outlets (3%), basement clutter (6%), fireplace (3%), gas (3%), and no exit (2%).

People's perceptions of the hazards of fabric ignition were tapped indirectly by asking, "How much more would you pay for a blouse or shirt [for yourself] made of flame-resistant fabric than an identical [one] not made of flame-resistant fabric?" Few people (6%) considered clothing ignition enough of a hazard to pay $6.00 extra. Some said they would pay an extra $1.00 (21%) or $3.00 (17%). A greater number (36%) indicated that they would not pay anything extra, and 17% said they did not know what they would do.

When asked about their perception of the cause of burns to different age groups, the sample did well on some items and poorly on others. Apparently, the adults were very aware of the need to supervise young children closely. Nearly everyone (96%) disagreed with the statement, "It is safe to leave an infant at home alone as long as the house is in clear view of the parents." However, whether people do leave infants alone is unknown. A moderate number of participants (47%) recognized matches and lighters as the most common cause of burns to children ages 4 to 9.

Just over half (51%) correctly agreed with the statement, "Water from a faucet can cause a burn serious enough to hospitalize a person for a month." Fewer (40%) correctly identified hot liquids as the most common cause of burns to children under 3. Respondents were also unaware of the causes of electrical burns to toddlers. Only 10% correctly said that "chewing on electrical cords" is a more frequent cause than "sticking things in electrical outlets" (76%).

Finally, participants were asked, "If you personally were to receive a burn serious enough to require a doctor's care this year, which of the following do you think would be the most *likely* cause of that burn?" Scalds, actually the most common type of burn for adults, were mentioned by only 29% of the participants. Other causes listed were: stoves (27%); house fires (20%); matches and smoking materials (12%); and electrical cords (4%).

Preventive Behaviors

Of the four knowledge domains, preventive behaviors ranked lowest. As mentioned, this may relate to the fact that all questions within the domain pertained to the individual's actual behaviors. None of the items fell in the high category and only one fell in the medium category.

TYPE OF KNOWLEDGE—PREVENTIVE BEHAVIORS

Question Number	Objectives	Type of Burn	Type of Product
HIGH			
—	—	—	—
MEDIUM			
22a	Families will have a plan of action in case of fire.	Flame	
LOW			
12	Flammable liquids will be stored safely to prevent fires.	Flame	Flammable Liquid
22b	Families will practice a plan of action for fires.	Flame	
23	Families will have a fire extinguisher in their home or apartment building.	Flame	
14	Families will have purchased flame-resistant clothing.		Flammable Fabric
24	Families will have a smoke detector in their home or apartment building.		

Although 56% of the persons interviewed indicated that they have action plans in case of fire, only 31% had ever practiced that plan. Approximately 40% of the participants said they have fire extinguishers in their homes or apartment buildings, but only 11% have smoke detectors.

When asked which of several precautions they take "when storing flammable liquids like gasoline or paint thinners," none mentioned were taken by more than half of the participants. Most people said, "keep out of living area" (43%), followed by "keep in a tightly capped container" (31%), "keep away from children" (29%), "keep in a ventilated place" (25%), "keep in a metal container" (20%), and "keep away from heat" (14%).

Asked whether they had ever purchased flame-resistant clothing, 39% said "yes," 36% said they had not, and 16% said they may have but were not sure.

Behaviors to Minimize Harm

Knowledge of behaviors to minimize harm ranked highest among the four knowledge domains; it is the only area for which the average score was above 50%. Even so, only one of the four items fell in the high category.

TYPE OF KNOWLEDGE—BEHAVIORS TO MINIMIZE HARM

Question Number	Objectives	Type of Burn	Type Product
HIGH			
10	Identify generally used methods for extinguishing burning clothing.	Flame	
MEDIUM			
8	Explain correct ways to control common household fires.	Flame	
11	Recognize correct steps for immediate treatment of severe burns.		
LOW			
9	Recognize correct steps for immediate treatment of a severe scald (remove clothing).	Scald	

The one item that fell in the low group pertained to the immediate treatment of severe scalds. One-fourth of the participants gave the correct answer, "remove your wet clothes." Most people (50%) said, "put cold water on it." Approximately 10% said to apply lotion or butter.

Items in the medium category related to controlling common household fires and treating severe burns. When asked, "If someone was burned in your presence, what is the first thing you would put on the burn?" most persons (53%) again said cold water. However, apply butter, vaseline or burn cream was mentioned by nearly 18% of the respondents.

Participants were also asked how they would put out a grease fire in a frying pan. Again, the majority gave right answers (baking soda, 29%; salt, 23%; smother with a cover, 31%). But several quite hazardous responses were also given: smother the fire with a towel or cloth, which could ignite (6%); put water on it, which could splatter the grease (8%); throw flour on it, which could explode (9%).

Virtually everyone knew that you should "drop and roll" to extinguish burning clothing (88% gave it as a first response and 11% as the second response).

Is Knowledge Related to Selected Sample Characteristics?

Overall knowledge for the adults interviewed through the telephone survey was analyzed by sex, age, presence or absence of children under 3, income, previous burn experience, and previous burn/fire safety instruction. As one would expect with a sample of this size (N = 599), a few significant relationships did occur, although the "real" difference amounted to only one or two points. Statistically, small differences emerged between knowledge and age: the 35-to-44-year-old group scored highest, and the 65-and-over group scored lowest. This difference may not mean the elderly group knows less, but they have difficulty hearing the questions, take longer to respond, etc.

There was a tendency for higher income groups to earn more points on knowledge. Somewhat surprisingly, but in accord with all other age groups, people who said they had been burned at some time in their lives did not appear to know more about burn prevention than those who had not been burned. People who reported having had some previous instruction in burn/fire prevention did slightly better than those who had no previous instruction.

Knowledge by Sex

The mean scores of adult men and women were not significantly different, as indicated below. The recoded score distribution also indicates the similarity between them.

Overall Scores by Sex

Sex	N	Mean*	Standard Deviation
Male	291	10.6	2.8
Female	307	10.9	2.7

*A t test on raw scores resulted in failure to reject the H^o at level $\alpha = .05$.

Recoded Scores by Sex*

Sex	N	Low (0-8)	Low Average (9-11)	High Average (12-14)	High (15 & over)
Male	291	20.3%	39.9%	32.6%	7.2%
Female	307	17.9%	37.5%	36.8%	7.8%

*A chi-square test on raw scores resulted in rejection of the H^o at level $= .05$.

A few significant differences between men and women do appear when the scores for each domain are examined, however. Women performed better than men on items related to knowledge of behaviors to minimize harm and of contact burns. Men performed better than women on knowledge of preventive behaviors and of electrical burns. The relevant data are presented below.

KNOWLEDGE BY SEX
(expressed in average percent correct)

	Male	Female
ALL ITEMS	46	47
Type of Knowledge		
Facts and Concepts	46	45
General Awareness	46	47
Preventive Behaviors*	41	37
Behaviors to Minimize Harm*	53	60
Type of Burn		
Flame	44	42
Contact*	15	20
Electrical*	6	4
Scald	41	39

*A t test on raw scores resulted in rejection of the H^o at level $\alpha = .05$.

Knowledge by Age

An examination of the mean and recoded scores of the telephone sample revealed significant differences across age groups. The 35-to-44 age group had the highest mean score and the greatest proportion of high recoded scores. The 65-and-over age group had the lowest mean; almost half of the score fell in the low recoded score group. The data are presented below.

Overall Knowledge by Age

Age	N	Mean*	Standard Deviation
15-24	93	10.6	2.5
25-34	158	11.2	2.3
35-44	98	11.7	2.8
45-54	101	10.8	2.4
55-64	70	10.7	2.5
65 and over	76	9.2	3.3

*An ANOVA test on raw scores resulted in rejection of the H^0 at level = .05.

Knowledge by Presence or Absence of Children Under Age 3

As shown below, there were no significant differences between parents of children under 3 and other adults on mean total score.

Children Under 3	N	Mean*	Standard Deviation
Yes	80	11.4	2.6
No	439	11.0	2.4

*A t test on raw scores resulted in failure to reject the H^{o} at level $\alpha = .05$.

Knowledge by Income

An examination of the mean scores by income for the telephone survey revealed significant knowledge differences. There was a slight tendency for those with higher incomes to do better than persons with lower incomes.

Income	N	Mean*	Standard Deviation
Under $5,000	61	9.1	2.9
$5,000-10,000	85	10.7	2.6
$10,000-20,000	211	11.0	2.4
Over $20,000	109	11.5	2.5

*An ANOVA test on raw scores resulted in rejection of the H^{o} at level $\alpha = .05$.

Knowledge by Burn History

Data from the telephone survey do not support the hypothesis that people who have been burned seriously know more about burn and fire prevention. As shown in the next table, there were no significant knowledge differences between persons who had been burned seriously and those who had not. This finding may be somewhat surprising, but it is in accord with results of the educational diagnosis for the other age groups.

Respondent Seriously Burned	N	Mean*	Standard Deviation
Yes	59	11.1	2.5
No	540	10.7	2.7

*A t test on raw scores resulted in failure to reject the H^{o} at level $\alpha = .05$.

Knowledge by Fire Safety Information

A comparison of the total mean scores of persons who had received fire safety information with those who had not reveals a small, but significant difference, with the former group doing better.

Received Fire Safety Information	N	Mean*	Standard Deviation
Yes	345	11.3	2.5
No	254	10.0	2.8

*A t test on the raw scores resulted in rejection of the H^O at level $\alpha = .05$.

Children Under 3 and Their Parents

Summary: Children Under 3 and Their Parents

Children under 3 comprise 14.6% of the state's reported burn population, yet account for only 4.8% of the total population of Massachusetts. In terms of burn incidence, this group is at greater risk than any other age group and twice as many boys are burned as girls. Scald burns account for almost two-thirds of the injuries. Contact burns comprise approximately one-fourth of the injuries. Chemical burns, to which this age group is particularly prone, and flame burns are remarkably low.

The profile data on burn victims under 3 years of age residing in the Boston SMSA (experimental site) allow certain generalizations:

- The most common cause of scalds is hot liquid (coffee, tea, water) left unattended within reach of a child.
- The quality of supervision is a critical factor in both scald and contact burns. In many cases a caretaker was surprised by the ever-changing ability of young children to reach, crawl, and walk. Caretakers often underestimate the child's capacities.
- Electrical burns for this age group are subject to misunderstanding, also. Most people are alert to the danger that wall sockets present to young children, but are unfamiliar with the much more frequent event of children putting extension cord joints in their mouths. The potential severity of the injury is often misjudged.
- Large gatherings of adults (as in parties or family reunions) are often the scene of a burn injury to children in this age group. It is assumed that "someone else is watching the child," who often wanders off and into trouble. Situations in which there is a lot of commotion are also conducive to a child's wandering off

and injuring himself. Examples of such situations are: breakfast and dinner time, and times of change in the child's physical surroundings, such as visits to another home or renovation of a home.

- The flame burn, although infrequent, is the most severe burn for this age group in terms of fatality and length of hospital stay. However, approximately half of all scald victims are hospitalized. The majority stay in the hospital from ten days to a month.
- Parents often apply proper first aid, except for electrical burns, which are often underestimated in seriousness. In instances where first aid was correctly applied for electrical burns, parents often did not know why they knew what to do.

The educational diagnosis of parents of children under 3 revealed the following generalizations:

- Parents got slightly more than half of the items correct overall (an average 54% correct).
- They knew most about behaviors to minimize harm, less about preventive behaviors and causes and consequences of burns, and least about underlying facts and concepts.

When the educational diagnosis for this group was related to the incidence data, an interesting observation emerged: knowledge deficiencies were not necessarily related to high incidence. For example:

- Parents did best on knowledge related to scald burns, the most common burn for the 0-to-3 age group. They could identify most potential hazards to young children as well as the proper treatment of scalds.
- On items related to stoves and space heaters (frequent sources of contact burns in this age group) parents scored in the upper range of knowledge by product involved.

These two facts suggest that other factors may be more crucial than knowledge per se: for example, lack of adequate supervision, underestimating the capabilities of young children, and hurried situations.

The few items related to scald and contact burns on which this parent sample scored poorly include:

- Recognizing that children under 3 are burned most often by scalds.

- Explaining that storing goodies above the stove could tempt children to climb on the stove or touch a hot stove.

- Identifying the safe location of controls on a stove--out of reach of young children, but not behind the burners.

Electrical burns were observed among the children in the profile data, although incidence was not high. The parents scored low on important items relating to electrical burns. In particular, they did not:

- Identify the dangers to children of sucking on extension cord joints or poking things into joints.

- Identify proper storage of electrical cords when not in use.

Although flame burns were remarkably low in the incidence data, the profile data revealed that they were often fatal when they did occur. Parents did poorly on:

- Predicting the extent of harm to a young child involved in a clothing ignition accident.

- Recognizing the age at which young children are capable of lighting a match.

Parents' knowledge was not related significantly to any characteristic measured: age, sex, socioeconomic status, income level, exposure to fire/burn safety information, or burn history.

Burn Injuries Occurring to Children Under 3

State Burn Incidence Data

What do the data from the Massachusetts Reporting System indicate about burn incidence among children under 3?

Approximately 14.6% (89 cases out of 611) of the state's reported burn population was under 3 years of age. This age group accounts for only 4.8% of the total population of Massachusetts. Of the 64 victims for which sex was noted, 44 were male (69%) and 20 were female (31%). In this age group the total Massachusetts population are 51% male and 49% female. Of these burn victims, 61% were treated and released, and 38% were hospitalized.

The distribution of burn injury types is presented below.

	Scalds	Contact	Flame	Chemical	Unknown
N	57	21	3	3	5
%	64%	24%	3%	3%	6%

Scald Burns = 64% (57 cases)

The largest number of children were the victims of scalds. Thirty-two of these accidents (56.1%) were kitchen/cooking/serving accidents. Ten children (17.5%) were scalded by domestic hot water systems, mainly in bathtub accidents. In 15 cases (26.3%) the circumstances of the scald were unknown.

Contact Burns = 23.6% (21 cases)

Four children in this group (19.1%) were burned from contact with radiators or radiation piping, 2 (9.5%) from space heaters, 8 (38.1%) in kitchen accidents (7 of these were from contacting the stove), 4 (19.1%) from irons, and the rest (14.3%) from miscellaneous causes.

Other Burns = 12% (11 cases)

This group includes 3 chemical burn victims and 3 flame burn victims. There were no electrical burns. Five burns were of an unknown type.

Burn Victim Profile Data

What Are the Characteristics of the Burn Victim for Children Under 3?

Altogether, 116 children residing in the Boston SMSA were included in this profile study. The following table describes certain demographic characteristics of this sample.

DEMOGRAPHIC CHARACTERISTICS: CHILDREN UNDER THREE

	N	% Total	% Respondents
Sex			
Male	68	58.6	58.6
Female	48	41.4	41.4
Race			
White	94	81.0	81.0
Black	19	16.4	16.4
Other (Hispanic) =	3	2.6	2.6
Household Type			
Both Parents/Children	85	73.3	83.3
Single Parent/Children	12	10.3	11.7
Other	5	4.3	4.9
No Answer	14	12.1	—
Number of Siblings			
One	30	25.9	30.0
Two	35	30.2	35.0
Three	16	13.8	16.0
Four	7	6.0	7.0
Five	6	5.2	6.0
Six	1	0.9	1.0
Seven or more	5	4.3	5.0
No Answer	16	13.8	—
Home			
Owned	28	24.1	32.2
Rented	59	50.9	67.8
No Answer	29	25.0	—

Slightly more than half (59%) are males; 41% are females. The majority (81%) are white, while 16% are black and 3% are of Hispanic origin. Over three-fourths (83%) live in households where both parents are present, while 12% come from one-parent households and 5% have other household arrangements. Approximately one-third (30%) are only children. Another third (35%) have one sibling, and the rest have from two to more than seven siblings.

In more than two-thirds of the cases (68%), homes are rented. In nearly all cases (99%) the children were at home when the accidents occurred.

What Types of Burn Accident Happen to Children Under 3?

The distribution of injuries in the profile data* is as follows:

			Other			
N=116	Scald	Flame	Contact	Chemical	Radiation	Electrical
N	46	8	41	4	—	17
%	40%	7%	35%	3%	—	15%

What Is the Relative Severity of Burn Injuries in This Age Group?

The burn severity for major types of burns is presented in the following table.

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*The distribution by type of burn in this sample differs from the burn-type distribution in the state-reported burn incidence data. This sample reflects the interests and mandate of the agencies (BISU and CPSC) which conducted the investigations. A major focus of both agencies was flammable clothing since federal legislators were considering the need for federal standards to regulate the flammability of clothing. Hence, the sample includes a disproportionate number of severe flame burns. However, the severity of these burn injuries (discussed below) provides justification for studying this kind of accident in depth.

BURN INJURY INVESTIGATION DATA:
MEDICAL FACTORS FOR CHILDREN UNDER THREE

		% Respondents			
	N	All Burns	Scald	Flame	Other
Medical Treatment	N= 113		27	56	30
Treated and Released	52	46	56	32	63
Expired	5	4	—	9	—
Hospitalized	56	50	45	58	37
Length of Hospital Stay					
Not Hospitalized	75				
Hospitalized	N= 40		21	6	11
1-9 days	13	34	29	33	45
10-29 days	20	52	57	33	55
30-49 days	4	11	14	17	—
Over 50 days	1	3	—	17	—
Not Ascertained	2				
Extent of Burns					
Total Body Surface Area Burned	N= 116		46	8	62
Less than 5%	65	56	28	50	78
5-19%	24	20	44	13	5
20-39%	6	5	7	25	2
More than 40%	21	18	22	13	16
Body Surface Area With Third Degree Burns:					
No Third Degree Burns	20				
With Third Degree Burns	N= 96		40	3	53
Less than 5%	94	98	95	100	100
5-19%	1	1	3	—	—
20-39%	1	1	3	—	—
More than 40%	—	—	—	—	—
Body Area Injured					
Was Face Involved?	N= 116		45	8	62
No	76	66	69	50	66
Yes	39	33	31	50	34
Not Ascertained	1				
Were Hands Involved?	N= 116		44	8	62
No	79	69	88	38	60
Yes	35	30	11	63	40
Not Ascertained	2				
Were Genitalia Involved?	N= 116		45	7	62
No	111	97	96	100	98
Yes	3	3	4	—	2
Not Ascertained	2				

* The percentages in the charts do not always add up to exactly 100% due to rounding error.

Scalds and contact burns presented the greatest hazard to this age group. Scalds were the most frequent injuries (46 cases) and required hospitalization in over half of the cases. Flame burns were relatively uncommon (8 cases), yet 5 of the victims were hospitalized. Contact and electrical burns were more common (62 cases), yet only 15 victims were hospitalized. Children with scald or contact/electrical burns were hospitalized most frequently for ten to thirty days. The one fatality in this sample was caused by a flame burn.

The extent of injury was most extensive for victims of scald burns: 73% of these burns affected more than 5% of the body surface area. Other types of burn did not exceed 5% BSA in more than half of the cases. The electrical burns of the mouth were small in extent but serious, since facial disfigurement and functional problems of the mouth were the usual consequences.

When, Why and How Do Injuries Occur?

Scald Burns

In the typical "kitchen scald," children are injured when supervision lapses momentarily, when someone spills hot liquid or grease on them, or when their own curiosity prompts them to reach out and spill things on themselves. The profile data revealed that children were scalded in the following ways:

- 31 by coffee, tea, or hot water
- 5 from hot bath water
- 3 by hot grease or oil
- 7 in other domestic accidents (vaporizers, etc.)

Over 90% of these accidents occurred at home: kitchens (72%), bathrooms/basements (17%), bedrooms (9%), and living rooms (2%).

It is of no surprise that most accidents took place in the colder months: fall (37%), winter (35%), spring (23%). Only 6% occurred during summer. Two-thirds of the accidents happened during the week and one-third on the weekend. The disproportionate number on weekends is possibly explained by higher food and beverage consumption plus changed activities.

Peak times for accidents were 6 A.M. to 9 A.M. (33%) and from 3 P.M. to 9 P.M. (36%), often hectic times which include such activities as fixing and eating breakfast, getting children bathed and dressed for the day, preparing and eating dinner, and getting children ready for bed.

Only one child had a serious disability at the time of the accident. The majority of the children (72%) were injured as a result of their own activity. Another 20% were injured as innocent bystanders, and 9% were hurt as innocent bystanders and because of their own activity.

Fifteen parents of these children were interviewed by project staff. Below are brief sketches of their children's accidents:

> A 12-month-old male crawled into the bathroom and turned on the outside faucet, which regulated the hot water. Attached to the faucet was a hose which squirted the water. (Not hospitalized.)
>
> A 14-month-old female was scalded when she decided to give herself a bath. Mother told victim she would bathe her, but was interrupted by the calls of two other children who were ill. Mother found the screaming child sitting in the sink. (Hospitalized 21 days.)
>
> An 11-month-old male was scalded by a Corning Ware percolator carried by mother, which "bottomed out" and caused the victim to be drenched. (Hospitalized 10 days.)
>
> A 2-year-old male was scalded when the inner bag of a nursing bottle his mother was filling gave way. (Hospitalized 1 day.)
>
> A 13-month-old male was scalded when he upset a cup of coffee on the kitchen table, left momentarily unattended by his father. (Hospitalized 9 days.)
>
> A 14-month-old female scalded a finger when she dipped it into tea that her father had left momentarily unattended. Mother saw what was about to occur, but couldn't stop it. (Not hospitalized.)
>
> A 16-month-old female was scalded when she grabbed cup from stove. Mother had deliberately left it there so child wouldn't reach it. (Hospitalized 26 days.)
>
> An 18-month-old female was scalded when she left a family gathering and reached for a mug of hot water (similar to the one from which she drank orange juice) that had been left on a low counter. (Hospitalized 26 days.)

An 18-month-old female was scalded when she upset a cup placed on a table; the cup was left unattended while mother went to close the safety gate to protect the child. (Hospitalized 17 days.)

A 22-month-old female was scalded when she ran under her father's arm, grabbed his mug and upset the coffee, thinking the mug contained orange juice she had been drinking. (Not hospitalized.)

A 23-month-old female was scalded as she reached for toast and upset a teacup set out for company. Caretaker had left to announce that tea was served. (Not hospitalized.)

A 2-year-old male was scalded when left momentarily unattended while mother went to bathroom and father was in the living room; victim climbed on stove and upset a one-quart pot of hot water. (Treated initially as an outpatient but admitted for 10 days because of ensuing infection.)

A 13-month-old male was scalded while his father was cooking bacon on an electric grill; victim pulled cord hanging over counter. Father underestimated child's capacity to reach. (Hospitalized 7 days.)

An 18-month-old female was scalded when she climbed on a counter, pulled on the cord of an electric percolator, and spilled the contents on herself. Kitchen was in the process of being remodelled. (Not hospitalized.)

A 19-month-old male was scalded when he pulled at the cord of a percolator placed on a kitchen shelf; cord was unusually long. (Hospitalized 6 days.)

Caretakers other than mothers were responsible for the child's care at the time of accident in seven of the fifteen cases. These include baby-sitters, grandparents, and fathers. Possibly the caretaker underestimated the child's capacity or was not wholly familiar with the current nuances of the child's behavior. For all caretakers, including mothers, momentary inattention was a recurrent item. That mothers--who presumably know their children's behavior best --can also be fooled by their children's newly developed agility was evident in at least four cases.

Much commotion was evident during the time of accident in at least three instances. The accidents occurred during a family gathering, when adults thought that someone was looking after the child; while a kitchen was being renovated; and when two siblings were ill.

Parents most commonly responded to the emergency by applying cold water and immediately transporting the child to the hospital. (However, butter or ointment also appeared to be popular home remedies.) When asked how they knew to remove hot clothing or apply cold water, parents were unsure of the reasons behind such procedures. Phrases such as "instinctive," "it felt wet," and "Mother told me," were used. Friends and relatives proved helpful, as the summation of several people's knowledge was often used. Several mothers stated that if they had been alone when the accident occurred, they would not have known what to do.

With regard to sibling order, two of the children were only children and one was the oldest child. All others were the youngest siblings, in families ranging from two to six children. One might hypothesize that with first-born children, parents' knowledge is limited and they do not anticipate a child's actions well. With the last-born child, parents might be distracted by other children or have less time to watch the baby. Older siblings might assume some of the caretaking responsibilities.

Many parents mentioned the pediatrician's or hospital's lack of concern, and complained of uncommunicative, slow, and confusing treatment. These comments were especially evident in families whose children were seen either by a physician whom the parents perceived to be a burn expert, or by a burn unit. The parents stressed the need for better communication between medical staff and victim/parents. They also wished quick, noncontradictory first-aid information and care were readily available.

Flame Burns

Being near an ignition source (stove, burning leaves, etc.) accounted for half of the flame-burn accidents. Matches were not a significant factor, for these children were a bit young for match play; there was only one case of this kind in the sample. One child was burned in a house fire and two were simply designated as "other" flame-burn accidents. Although no conclusions about patterns can be drawn from this small sample, it is perhaps worth noting that half of the accidents happened on the weekends. Most occurred in the fall, and 75% occurred at the victim's residence. One child died from flame injuries.

Only one family was interviewed by project staff:

> The pants of a 23-month-old male caught on fire as he sat in front of a pile of leaves, watching them smolder. A gust of wind fanned the flames, which set his pants on fire. (Hospitalized 27 days.)

This child was unusually young for this kind of flammable fabrics accident. Nevertheless, the case points out the need to use caution with children of all ages when burning leaves, rubbish, grass, etc. According to the mother, the day of the accident was a particularly breezy day. Although the fire had been doused once with water, it had rekindled itself with the sharp wind.

The need for constant adult supervision of children this age is also illustrated by this accident. In this case the child was being supervised by a five-year-old sister. The children were playing in a neighbor's yard, with parents keeping an eye and ear open from their own house. Children five years old do not have enough experience to know how to act in emergency situations. They have been known to panic, to try and beat out flames themselves, and to search for adults to help them, sometimes in vain. In this case, luckily an adult spotted and extinguished the flames.

Other Types of Burns

This category is disproportionately large for this age group, due to the significant numbers of contact burns (35%) and electrical burns (15%), with a few chemical burns (3%) to complete the list.

Below are listed the various products and activities involved in these accidents:

Contact Burns

- 15 from stoves or ovens
- 13 from room heaters
- 9 from irons, hair dryers, heating pads, other
- 4 from other cooking equipment

Electrical Burns

- 16 from household appliances or extension cord joints
- 1 from a wall socket

Chemical Burns

- 4 (no specific information)

Seasonal peaks for the accidents were winter (33%) and summer (32%) with a decline in fall (20%) and spring (17%). Two-thirds occurred during the week (67%), with the last third on the weekend. Peak times of the day were 3 to 9 P.M. (50%) and 9 A.M. to noon (15%).

Accidents occurred mostly at home (89%): kitchens (34%), living rooms (26%), bathrooms/basements (17%), bedrooms (15%), and yard/patio/porch (7%). The product involved in each accident reflects the location of the accident.

Parents of seven of the children were interviewed by project staff. Four sustained contact burns and three suffered electrical burns.

Contact Burns

> An 8-month-old male, just learning to crawl, grabbed on to a radiator and couldn't let go. (Not hospitalized.)
>
> A 9-month-old male placed palms of hands against a defective oven door. Couldn't let go because he was afraid to fall. (Not hospitalized.)
>
> A 16-month-old male tipped over a barbecue grill that had been used three hours prior to accident. (Hospitalized 14 days.)
>
> A 2-year-old male grabbed or pulled on a hot iron which was left out by father, who had been in a hurry, after ironing a shirt. (Not hospitalized.)

Children who have just begun ambulating seem to be especially vulnerable to contact burns because of their need to lean against objects for support. Therefore, one must be specially careful during the toddler period to make sure that objects such as pipes, heaters, and ovens are properly insulated. In addition, first children present a special problem. Parents who are not used to infants in their household often adapt the arrangement of the household through experience rather than through anticipation of the child's developmental progress. After the accidents occurred all victims avoided and feared those objects on which they were burned.

Of the four children, all but one were treated promptly with cold water. A Haitian family, in addition to applying water, also applied honey, a local remedy, to the affected area. In the one case where nothing was done, the victim's mother voiced her frustration that *fifteen* adults were present and no one really knew what to do. Two mothers were dissatisfied with the medical care their children received, characterizing it as cursory and the medical staff as uncommunicative.

Electrical Burns

> A 14-month-old female sucked on the free end of a plugged extension cord. Father called 911 for information. (Hospitalized 15 days.)
>
> A 10-month-old female sucked on a lamp cord; she was not taken to an emergency room until the morning after the injury as her parents had been misinformed by the baby-sitter about how her injury occurred. (Not hospitalized.)
>
> A 2-year-old male bit into a TV cord while watching television. (Not hospitalized.)

In two cases, the normal caretaker was not home at the time of the accident. In the other case, the parents were not fully attentive to the child.

In all cases, no immediate first aid was given. After one pediatrician was contacted, he suggested that the parents do nothing, but bring the child straight to his office. It is interesting that in one family there had been two serious burn accidents--the father had been scalded by an overheated battery and another family member had walked into hot coals --but the family still did not know appropriate emergency burn care. In both of the aforementioned accidents, this family had been assisted by bystanders; the mother felt that burn information was confusing and contradictory. One mother felt that her child had been given insufficient treatment.

In all cases, baby-sitters and parents underestimated the seriousness of the injury. In general, many people do not understand what happens when electric current passes through body tissues. Only if swelling and other visible damage is evident do they see a physician. They are not aware that underlying tissue can be destroyed with no visible evidence, and that delay can mean the difference between relatively short treatment and treatment complicated by infection.

It is also disturbing that parents saw these accidents as unavoidable. Electrical burns to the mouth, though relatively small (usually less than 5% BSA), are serious in that they usually are third-degree burns, involve tissue in the oral cavity as well as the lips, and may affect the child's eating capacity. In addition, scarring may necessitate plastic surgery.

Experienced parents know that children at a certain age will place anything into their mouths. But new parents, baby-sitters, or grandparents may not know this, or may not be schooled in the whens and whys. In the case of an emotionally needy child, the risks may last beyond the expected period.

Educational Diagnosis: Parents of Children Under 3

A special booklet of seven items concerning risks for children under 3 was administered at home to parents before the interviews took place. Since an insufficient number of parents from the telephone survey agreed to a follow-up home interview, names were selected from health clinic files in two towns within the SMSA. From this list, 28 persons agreed to be interviewed.

Individual Items

Parents did poorly on items related to awareness of scalds as the greatest risk to toddlers, the age at which children can light a match, and consequences associated with clothing ignition, and in identifying a correct place to store an electric cord not in use.

They did very well on items about preventive behaviors such as storing matches out of reach and covering exposed outlets. They were also aware of danger to young children from electrical cords. They knew young children should always be supervised, and never left alone in the house.

TYPE OF KNOWLEDGE—GENERAL AWARENESS

Question Number	Objectives	Type of Burn	Type of Product
HIGH			
3	Recognize that close supervision is necessary for protecting young children from fire or burn injuries.		
5	Identify burn dangers associated with extension cords.	Electrical	Electrical Sources
MEDIUM			
—	—	—	—
LOW			
1a	Predict results of a young child involved in a clothing ignition accident.	Flame	Flammable Fabric
7	Recognize the age at which young children have the capability of lighting a match.	Flame	Matches/Smoking Mat.
4	Recognize that young children 0-3 are most often burned by scalds.	Scald	

General Awareness

As shown in the table, parents did not seem aware of certain scald and flame risks to children. Only 39% correctly identified scalds as the most common type of burn for 0 to 3 years of age. Half thought that contact with hot objects was most common, 7% checked electrical sources, and 7% did not know. No one checked flame as most common.

These parents were not sure at what age a child would probably have enough strength and coordination to light a match. Only 25% correctly said 2 years, while 32% said 3 years and 18% said 4 years. However, in a related question they did show awareness of the consequences of a flame accident. The following situation was presented:

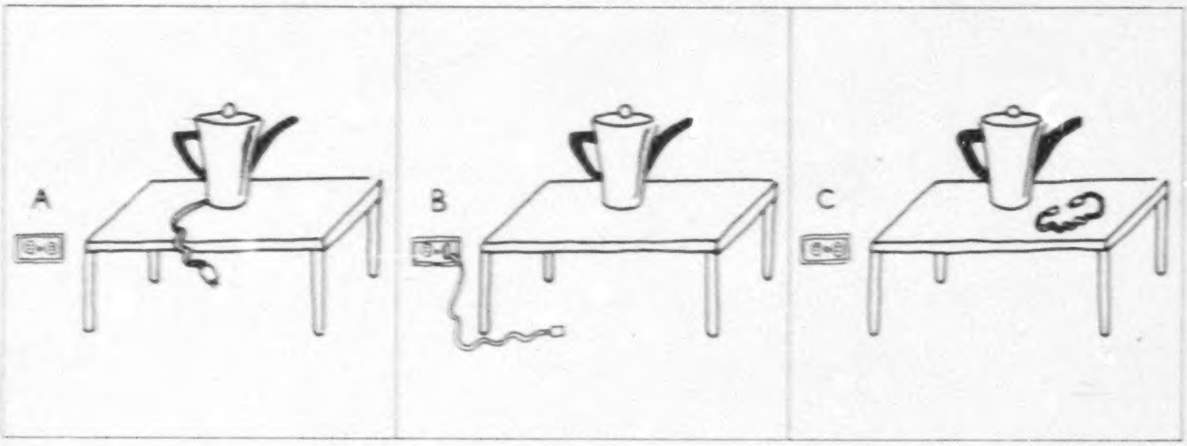
> Three-year-old Lynn was playing alone with matches in her living room. She dropped a flaming match on her cotton dress.

The majority (75%) said the child was apt to be burned seriously. The others said, "She can beat it out with her hands."

These parents seemed quite knowledgeable about general rules related to protecting young children from fire or burn injuries and about dangers related to extension cords. When asked under what circumstances an infant (in a crib) should be left alone at home, 96% said never, even if the house has a fire detector system or the house is in clear view of the parents. Four percent said the infants could be left alone "only after the adult carefully checks that no fire hazards are present." When asked why it is dangerous to use an extension cord, over 90% checked all of the possible correct responses: a young child might unplug a cord and get an electrical shock (96%); the cord might overheat and cause a fire (93%), and a young child might suck on the joint and burn his mouth (100%).

Preventive Behaviors

Although parents of toddlers seemed to know the dangers associated with using extension cords, they could not identify the best place for storing an electrical cord which is not in use. When presented with the following picture,



all chose "C," showing an unattached cord on the table. The correct response was "none of the above."

Parents did know the best way to protect little children from electrical burns: 86% checked "cover exposed outlets." However, 14% simply checked "scold them when they go near outlets."

TYPE OF KNOWLEDGE—PREVENTIVE BEHAVIORS

Question Number	Objectives	Type of Burn	Type of Product
HIGH	Recognize that to prevent burns one should:		
1b	Store matches in a safe place away from children.	Flame	Matches
2	Cover exposed outlets to protect children from electrical burns.	Electrical	Electrical Sources
MEDIUM			
—	—	—	—
LOW			
6	Store electrical cords out of children's reach.	Electrical	Electrical Sources

Parents also did well in identifying correct precautions to prevent injury to the child who dropped a match on her cotton dress. Over 80% said do not leave matches out, or put them in a drawer. About 25% suggested better supervision of the child or "don't let kids play with matches." Interestingly, about 20% suggested the purchase of flame-resistant clothing.

Additional information about knowledge held by parents can be found in section 5.

Elderly Persons

Summary: Elderly Persons

People over 60 years of age comprise 9.5% of the state burn incidence data, and 15.6% of the state's total population. The distribution of accidents for males and females parallels that of the state population. The incidence data indicate that flame burns occur slightly more often than scald burns. Contact, chemical, and electrical burns account for considerably fewer injuries.

The profile data on burns among the elderly in Boston allow certain generalizations:

- Although the incidence data indicate that the elderly are underrepresented in incidence, injuries sustained by them are severe: one-half of the elderly who are hospitalized for flame burns die from their injuries.
- Over one-third of these elderly burn victims live alone. This is a significant factor, when considering the importance of bystander assistance in emergency situations evident in the profile data for all age groups. It is also significant when considering the decreased ability of the elderly to respond quickly to emergencies.
- Almost half of the flame burn injuries involve matches or smoking materials. Of the smoking accidents, almost half happen while the victim is smoking in bed. Another third happen while the victim is smoking in an overstuffed chair.
- Cigarette lighter fluid and gas in gas ovens/ranges account for three-fifths of the flammable liquids involved in injuries; gasoline, the major hazard for younger people, is less frequently involved.
- Over half of the clothing ignition burns involved

sleepwear, a particular problem for home-bound elderly who might not change into streetwear at all during the day.

- Scald burns, though often less severe, constitute a problem for this age group. Most often, these burns involve hot coffee, tea, or water, although industrial scalds still occur as do scalds sustained from hot bath water.

The educational diagnosis indicates the following characteristics about elderly people's knowledge of fire and burn prevention:

- Overall scores are very low, with an average of only 30% correct for all questions. There is considerable variation in their knowledge by type of burn, with scores as high as 73% for smoke, 53% for scald, and only 32% for flame, for which half of the hospitalized injuries for the elderly result in death.

- Elderly people are very unaware of the causes and consequences of burn injuries, preventive behaviors and underlying concepts. They score well on knowledge of behaviors to minimize harm, but since many people in this age group die as a result of flame burns when clothing is ignited, it is possible that although they may know to "drop and roll," it may in fact be difficult for them to respond quickly enough to carry it out because of their decreased agility.

- Elderly people appear to be fairly knowledgeable about situations concerning scalds. The frequency with which scalds occur to the aged suggests that decreased agility may be a factor in spilling hot liquids upon oneself.

- It is apparent that there is great need for the elderly to have knowledge about flammable liquids because this is the lowest product subscore (14%). They particularly need more knowledge about the hazards of lighter fluid, a major cause of burns to them.

- Elderly people have only limited knowledge of burn prevention situations involving matches and smoking materials, ovens and ranges, and flammable fabrics. Indeed, these products are often interrelated in the accident patterns to the elderly. For example, lighter fluid spilled on a garment may be ignited by a match, also igniting the clothing.

- Reports which the elderly give of their burn or fire prevention practices include never having practiced a home fire exit drill; leaving a fire smoldering in the fireplace when going to bed; and not checking garments for the presence of flame-resistant tags.

- The elderly report that previously they had received their fire or burn prevention information primarily from the fire department or in a work situation. In the past, television and literature were not major sources of burn information to them. However, they do watch TV daily, especially between 8 and 11 PM.

- Gaining access to elderly people, who often live alone, is a difficult process. They tend to be suspicious of requests for their participation in research studies, and even though they may have free time, they were unwilling to participate in interviews. Identifying a key community leader whom they trust is an important consideration if educational intervention is to involve them.

Although elderly people do realize that they stand particular risks because of their slower reaction time, etc., important knowledge deficiencies exist related to scald and flame burns, and their corresponding products.

Scalds

With regard to scalds, elderly people:

- Do *not* recognize how to position pots correctly on burners, e.g., with handles turned inward and on correct-size burners.

Flame Burns

Flammable Liquids

Concerning flammable liquids, elderly people:

- Do not recognize risks associated with storing aerosol cans near heat.

- Do not recognize that to prevent burns they should *not* hold a cigarette lighter over their clothing while filling it with fluid.

- Do not know that lighter fluid fumes can ignite (even though they know the fluid itself can).

Flammable Fabrics

Concerning flammable fabrics, elderly people:

- Do not recognize the relative burning speed of various fabrics.
- Are not aware that there is an equal risk of clothing ignition from gas and electric stoves.

The educational diagnosis also indicates that there is some relationship between knowledge, the sex of the respondent, and prior fire/burn safety information. Women did significantly better than men on the subscores for scalds and ovens/ranges. Persons who had received fire/burn safety information had higher scores overall and on the following subscores: general awareness and behaviors to minimize harm in the type of knowledge domain; flame and smoke within type of burn; and flammable fabrics within type of product. There is no relationship between knowledge and socioeconomic status, income, or number of information sources mentioned.

Burn Injuries Occurring to Elderly People (60+ Years of Age)

State Burn Incidence Data

What do the data from the Massachusetts Reporting System indicate about burn incidence among persons aged 60 and older?

Approximately 9.5% (58 cases out of 611) of the state's reported burn population was 60 years of age or older. This age group accounts for 15.6% of the total population of Massachusetts. Of the 44 victims for which sex was noted, 19 were male (43%) and 25 were female (57%). Of this age group in the total Massachusetts population, 40% are male and 60% are female. Of these burn patients, 53% were treated and released, 44% were hospitalized, and one person (2%) was dead on arrival.

The distribution by type of burn injury is presented below.

	Scald	Flame	Contact	Chemical	Electrical
N	22	24	6	2	1
%	38%	41%	10%	3%	2%

Flame Burns = 41.4% (24 cases)

Unlike most other age groups, among persons aged 60 or over flame burns were more common than scalds. Of the 24 flame burns in this age group, only one accident (4.2%) happened while the person was using a flammable substance to clean paintbrushes. There were six instances of being burned while lighting a stove, cigar, cigarette, or pipe (25%); six burns (25%) resulted from actively using an ignition source such as a stove. Two victims (8.3%) were near explosions; four (16.7%) were in house fires; and one (4.2%) was in an auto fire. In the other four cases (16.7%), the circumstances were not specified.

Over half (fourteen) of these flame burn victims had ignited their clothing, most frequently while using the stove (four cases). Items of clothing ignited were: shirts or blouses (five cases), nightgowns (three cases), and housecoats or robes (two cases). Other items were not specified.

Scald Burns = 37.9% (22 cases)

As with other age groups, the largest number of scalds (nine cases, 40.9%) were kitchen- or food-related. In four cases (18.2%) the accident involved the domestic hot water system. In the other nine cases (40.9%) the circumstances of the accident were not specified.

Other Burns = 15% (9 cases)

The other nine burn accidents included six contact burns (10.3%)--two caused by a stove oven or burner--two chemical burns (3.4%), and one electrical burn from a lamp (1.7%).

Burn Victim Profile Data

What Are the Characteristics of the Elderly Burn Victims?

Ninety-three people residing in the Boston SMSA (experimental site) were included in this investigation. The following table describes these individuals with respect to social characteristics: sex, race, household type, marital status, educational background, and occupation.

DEMOGRAPHIC CHARACTERISTICS: ADULTS (60 YEARS OF AGE AND OVER)

	N	% Total	% Respondents
Sex			
Male	35	37.6	37.6
Female	58	62.4	62.4
Race			
White	89	95.7	95.7
Black	4	4.3	4.3
Home			
Owned	38	40.9	55.1
Rented	31	33.3	44.9
No Answer	24	25.8	—
Marital Status			
Married	38	40.9	42.7
Widowed	39	41.9	43.8
Divorced	3	3.2	3.4
Separated	9	9.7	10.1
No Answer	4	4.3	—
Household Type			
Both Parents/Children	9	9.7	10.0
Married	23	24.7	25.6
Related Adults	19	20.4	21.1
Alone	31	33.3	34.4
Other	6	6.5	8.8
No Answer	5	5.4	—
Education			
Grade School	9	9.7	21.9
Partial High School	8	8.6	19.5
High School Graduate	18	19.3	43.9
Partial College	4	4.3	9.8
College Graduate	2	2.2	4.9
No Answer	52	55.9	—
Occupation			
Employed Full-time	12	12.9	40.0
Employed Part-time	3	3.2	10.0
Housewife	14	15.1	46.7
Unemployed	1	1.1	3.3
Not Ascertained	63	67.7	—

The majority of the sample was white. Less than 5% was black, and no other minorities were represented. The male-to-female ratio was roughly 1:2, and was approximately constant across all three categories of burns. Overall, slightly less than half of the respondents were married

(43%) and slightly less than half were widowed (44%). One-third lived alone; one-fourth lived with their spouses; the rest lived with related adults (21%), with children (10%), and in other combinations. For those whose work status was determined (33%), approximately half (15%) were employed outside the home, the others were employed in the home (15%). Approximately half (45%) rented and half owned their own homes (55%). With respect to education, one-fifth (22%) had never attended high school. Over half (63%) had entered or completed high school. Only 15% had some college background; two persons had graduated from college.

What Types of Burn Accidents Happen to This Age Group?

The distribution of injuries in the profile data* is as follows:

	Scald	Flame	Contact	Chemical	Radiation	Electrical
N	13	71	7	—	—	2
%	14%	76%	8%	—	—	2%

What Is the Relative Severity of Burn Injuries in This Age Group?

For the elderly, flame burns affected over 75% of the sample. As noted, this partially reflects the bias of the data, but it also indicates the seriousness of flame burns among the elderly. Almost half of the victims died as a result of their injuries. Five were dead on arrival at a hospital and 28 (47%) expired after the first day of admission. These figures imply that when an elderly flame victim is hospitalized, chances are approximately fifty-fifty that the elderly patient will die from the complications or the burn.

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*The distribution by type of burn in this sample differs from the burn-type distribution in the state-reported burn incidence data. This sample reflects the interests and mandate of the agencies (BISU and CPSC) which conducted the investigations. A major focus of both agencies was flammable clothing since federal legislators were considering the need for federal standards to regulate the flammability of clothing. Hence, the sample includes a disproportionate number of severe flame burns. However, the severity of these burn injuries (discussed below) provides justification for studying this kind of accident in depth.

BURN INJURY INVESTIGATION DATA:
MEDICAL FACTORS FOR ADULTS 60 YEARS AND OVER

	N	% Respondents			
		All Burns	Scald	Flame	Other
Medical Treatment	N= 93		13	69	9
Treated and Released	26	28	54	17	78
Expired	33	36	—	48	—
Hospitalized	33	36	46	35	22
Not Ascertained	1				
Length of Hospital Stay					
Not Hospitalized	31				
Hospitalized*	N= 59		6	51	2
1-9 days	14	24	17	24	50
10-29 days	21	36	50	33	50
30-49 days	15	25	17	27	—
Over 50 days	9	15	17	19	—
Extent of Burns					
Total Body Surface Area Burned	N= 93		13	71	9
Less than 5%	19	20	39	11	67
5-19%	16	17	8	21	—
20-39%	10	11	8	13	—
More than 40%	48	51	46	55	33
Body Surface Area With Third Degree Burns:					
No Third Degree Burns	41				
With Third Degree Burns	N= 52		7	36	9
Less than 5%	32	62	100	44	100
5-19%	4	8	—	11	—
20-39%	4	8	—	11	—
More than 40%	12	23	—	33	—
Body Area Injured					
Was Face Involved?	N= 93		13	62	9
No	52	62	85	52	100
Yes	32	38	15	49	—
Not Ascertained	9				
Were Hands Involved?	N= 93		13	61	9
No	42	51	77	43	67
Yes	41	49	23	57	33
Not Ascertained	10				
Were Genitalia Involved?	N= 93		12	62	9
No	69	81	92	79	100
Yes	14	19	8	21	—
Not Ascertained	10				

* Includes 26 persons who expired.

Hands (57%) and face (49%) were involved in a significant number of flame burn accidents, increasing the severity and consequences of the injury. In 15% of the scald burn cases the face was injured. Hands were involved in slightly less (23%) than one-fourth of the scald burn sample. Genitalia were injured in 21% of the flame-burn accidents and 8% of the scalds.

The majority of scald victims (54%) were treated and released, compared to 17% of the flame burn victims. Most of the scald victims who were hospitalized (46%) stayed for less than thirty days (67%). Of the flame burn victims who were hospitalized (35%), approximately half stayed for less than thirty days.

With regard to the remaining injuries--which were primarily contact burns--78% of the patients were treated and released from the emergency room, and no hospitalization extended longer than a month.

When, Why, and How Do Injuries Occur?

Scald Burns

For the elderly who experienced scald burns, eight accidents were related to kitchens and mealtimes:

- 1 by soup, chowder, stew
- 1 by grease/oil
- 6 by hot coffee, tea, or water while preparing, serving, or drinking

Five were related to other activities:

- 1 by a domestic hot water system
- 1 in other domestic scenes
- 2 in industrial processes
- 1 by tar, wax, etc.

Scalds for the elderly occurred predominantly in fall (54%) and winter (23%). They occurred slightly more frequently on weekends (54%) than on weekdays (46%). The majority of accidents happened between 6 AM and 3 PM (53%), with fewest between midnight and 6 AM. The most common location of these accidents was the victim's home (80%), primarily in the kitchen (54%). Other indoor locations accounted for 15% of the accidents.

Most scald victims had no stated disabilities at the time of the accidents. Victims' responses during and after the accidents ranged from doing nothing to screaming, running, or removing hot liquid-soaked clothing from the source. Applying cold water (appropriate) or butter/ointment (inappropriate) were equally popular first-aid measures.

Five people in this sample were interviewed by the project staff:

> A 66-year-old male was scalded while pouring a cup of coffee. Accident was said to have been caused by victim's inexperience with coffee pots and the malfunction of the coffee urn top. (Not hospitalized.)
>
> A 69-year-old female was scalded while having tea with relatives she had not seen in years. She treated herself at home, but eventually had to go to the hospital.
>
> A 76-year-old female was scalded while reaching for tea on table. The saucer apparently could not hold the cup; tea fell on lap and genitalia. No ice or water applied because of haste to get to hospital. (Hospitalized.)
>
> A 62-year-old male, working as boiler fitter and fireman, fell waist-deep into 200° water. Permanently disabled with chronic psychological problems. (Hospitalized 210 days.)
>
> A 63-year-old male, working as a boiler fitter and trying to fix a leak, was scalded by a rush of backed-up water. (Hospitalized 4 days.)

These sketches illustrate the range of injury severity which the scald burn presents. The major scald burns tend to involve immersion in vats or tubs of hot water, or to involve steam blasts. The least severe burns tend to be coffee, tea, and domestic hot water scalds, which involve a smaller volume of hot liquid thereby causing less extensive burns.

Flame Burns

Victims in this sample (71 cases, 76%) were burned in the following manner:

- 1 direct flame burn
- 3 using flammable substances
- 22 lighting a fire
- 30 using an ignition source

- 9 being near an ignition source
- 3 house fires
- 3 other flame burns

Flame-related accidents revealed a striking seasonal pattern: winter (41%), fall (19%), and spring (11%). Days of occurrence were distributed equally throughout the days of the week (weekdays, 69%; weekends, 31%), suggesting that flame accidents occur when doing everyday chores. Most accidents occurred at home (87%); another [illegible]% took place in residential institutions. Specific locations of accidents were kitchens (49%), living rooms (21%), and bedrooms (19%).

Sleepwear ignition is a special problem in this age group, as those elderly people who do not go out often do not change out of sleepwear during the day. In accidents involving flammable fabrics, 57 in all, over half involved sleepwear. Of this 44% involved a housecoat, 31% involved a nightgown, and 25% involved pajamas.

Especially with flame accidents among the elderly, one has to ask whether a disability might have been a factor. For example, an individual might be unable to hold a match steadily, to hold a lighter, to have a steady hand over the stove, to react quickly in an emergency. In approximately half the cases (52%), there was some disability at the time of the accident. Of these, approximately one-fourth were disabled, bedridden, or drugged (26%); one-fourth (24%) had been drinking or had a history of alcoholism; approximately one-fifth (18%) had more than one disorder; and one-fourth (24%) had varying disabilities. These figures suggest that a relationship between disability and flame burns does exist for this risk group.

Almost all of the victims (89%) perceived the injury to have been a result of their own activity. One-tenth were injured as bystanders (6%) or involved in house fires (4%).

An impressive majority of the sample responded to the emergency in an inappropriate or ineffective manner by doing nothing, screaming, running, or trying to put out the flames with their hands. Only a few of the victims responded by dropping and rolling. Some respondents attempted to remove clothing or beat out flames, and though this response is not intrinsically incorrect, it is time-consuming and may risk additional hazards (e.g., burns to the hands and face, or smoke inhalation resulting from removing a burning garment over the head).

Bystanders tended to respond to a flame emergency by trying to remove clothing, beat out flames, or put them out with water. Again, these responses are time-consuming, especially when one considers that it takes a cotton dress approximately ten seconds to burn completely. Beating out a fire can also fan the flames. Half of the bystanders reacted by summoning emergency help or taking the victim to a hospital. Relatively few dropped and rolled the victim, or rolled a blanket around the victim. Those who responded correctly were approximately equal in numbers to those bystanders who did nothing.

The face, hands, and genitals were involved in more flame than other types of burns. Face burns, if they occur with clothing ignition, are due to the fanning effect caused by collar ignition. Hand burns typically result from trying to remove the burning garment, or from the radiating effect of burning sleeves. Genitalia tended to be burned by radiant heat or when under or outer wear covering the area has ignited.

Only four individuals (or their families) were interviewed by project staff. Their case histories illustrate some dimensions of the flame burn problem for the elderly:

> A 68-year-old female who smoked two to three packages/day was found in living room with housecoat smoldering by granddaughter. (Hospitalized 24 days; deceased.)
>
> A 69-year-old female resident of a psychiatric institution, diagnosed as being chronically depressed and suicidal, set her clothing on fire while in bathroom but ran out when "it hurt." (Hospitalized 49 days.)
>
> A 70-year-old female, a heavy smoker, was found by firemen. Her cigarette is thought to have slipped from an ashtray, igniting her nightgown and part of the house. (Hospitalized 18 days; deceased.)
>
> An 83-year-old male ignited shirt while making toast on stove. Immobilized by accident; found by daughter sitting at kitchen table with his shirt burned off. (Hospitalized 15 days; deceased.)

The decreased ability of the elderly to respond promptly and effectively to the emergency condition presented by clothes ignition is a disturbing problem for this risk group. Even elderly victims who have the knowledge and capacity to respond effectively in an emergency situation may be unable to act quickly enough because their response time is longer. The additional time clothing is on fire invariably means more extensive burn injuries.

Except for the destruction of garments in three of the above cases, there was little visible evidence of fire in the victim's room or home, although three of the victims died. This pattern of minimal property damage is characteristic of single-victim, single-ignition source accidents, especially those in which kitchen stoves serve as ignition sources.

In many clothing ignition incidents, the similarity between the pattern of burn damage to the garments involved and the distribution of burn injuries on the victim's body is evident. This phenomenon has been observed in cases involving victims of all ages, but is particularly characteristic of older victims, perhaps because elderly victims tend not to move while on fire, and thus there is less distortion in the burn pattern of the garments involved.

In both cases where fatalities were caused by smoking materials, the relatives participating in the interviews mentioned how dangerous smoking was for the elderly, and how they wished that the victim had been able to stop smoking. This problem of elderly people smoking despite the disabilities associated with advancing age is a grave one, because smoking is often one of the few pleasures left to them. Staff in residential settings for the elderly should take care not to leave matches around, for they may tempt those who have restricted smoking privileges or are acutely depressed.

Other Types of Burns

The sample for this category was very small, and any observations must be made with this in mind.

These burns included contact and electrical burns:

- 1 contact burn from a heater
- 2 contact burns from heating stoves
- 1 contact burn from food preparation
- 3 contact burns from engines, industrial processes, irons, etc.

Accidents in this category were spread evenly according to seasons: spring (38%), winter (25%), fall (25%), and summer (13%). The majority occurred during the weekdays (88%). Half occurred between 6 PM and midnight, and the rest were spread evenly between the hours of 6 AM and 6 PM. All accidents occurred at home: kitchen (33%), bedroom (33%), living room (22%), and other indoor locations (11%).

Over half of the victims (56%) had medical disorders at the time the accidents occurred. Most of the disorders (46%) fell in the unspecified category of "other." The rest included disabled, bedridden, and drugged (20%); seizure and other disorder (20%); and more than one disorder (20%).

Ninety percent of the victims felt that they were injured as a result of their own activity. One victim was injured as a result of an unknown factor in an industrial accident.

Victim response in these accidents is interesting in that over one-third of the victims delayed any kind of medical treatment until symptoms became worse, implying that they were not cognizant of being burned, and/or the extent of burn. A large number of victims did nothing. Others applied vaseline, oil, butter, or a dry dressing. Significant in bystander response is that over half did nothing, while most of the rest encouraged victim to go to the hospital.

Three individuals were interviewed by project staff:

> A 64-year-old female with a progressive neurological disorder was burned while using a heating pad to lessen disease-related pain. Pad was malfunctioning, but the victim could not feel area of burn well. (Hospitalized 24 days.)
>
> A 68-year-old female was burned while using a borrowed heating pad to alleviate pain from a fall; victim fell asleep with pad still on. (Not hospitalized.)
>
> A 60-year-old male was involved in an asphalt/steam explosion. Victim felt strongly that working area and practices were unsafe. (Hospitalized.)

People with chronic neurological diseases are especially prone to burns and other related accidents, as often they suffer from complete or partial loss of sensation. The victim with Frideriech's disease was burned twice by a malfunctioning heating pad, but sought no treatment because she had no sensation in the area. Even the VNA nurse underestimated the seriousness of the burn.

Educational Diagnosis: Elderly

Characteristics of the Elderly Sample

The elderly sample interviewed consisted of 33 persons from the Boston SMSA (experimental site) with two-thirds from elderly housing projects. The table on the following page describes the sample in terms of several characteristics: sex, age, race, marital status, socioeconomic status, income, number in household, and number of children.

The sample was divided evenly between men and women. Most were white (91%) and between the ages of 60 and 80 (82%). As with other experimental samples, less than 10% came from minority groups. Over half of the sample (58%) were married; another third were widowed; and the remainder (9%) had never been married. The sample was divided fairly evenly among the three middle SES groups (using Hollingshead's classification), with only 10% in the lowest group and none in the highest group.

Most of the sample (76%) reported incomes under $10,000, with 41% reporting less than $5,000. Nearly everyone (97%) lived in a small household with four persons or less; few (6%) have children at home.

DEMOGRAPHIC CHARACTERISTICS

	Elderly (N=33)		
	N	% Total	% Respondents
Sex			
Male	16	48.5	50.0
Female	16	48.5	50.0
No Answer	1	3.0	—
Age			
50-59	2	6.1	6.1
60-69	13	39.4	39.4
70-79	14	42.4	42.4
80-89	3	9.1	9.1
90 and over	1	3.0	3.0
Race			
White	30	90.9	90.9
Black	2	6.1	6.1
Other*	1	3.0	3.0
Marital Status			
Married	19	57.6	57.6
Widowed	11	33.3	33.3
Never Married	3	9.1	9.1
Socioeconomic Status			
High	—	—	—
	6	18.2	20.7
Middle	9	27.3	31.0
	11	33.3	37.9
Low	3	9.1	10.3
No Answer	4	12.1	—
Income			
Under $5,000	12	36.4	41.4
$5,000-$10,000	10	30.3	34.5
$10,000-$15,000	4	12.1	13.8
$15,000-$20,000	—	—	—
$20,000-$25,000	1	3.0	3.4
Over $25,000	2	6.1	6.9
No Answer	4	12.1	—
Number in Household	32	97.0	97.0
1-4	1	3.0	3.0
5-6			
Children Age 3-16	31	93.9	93.9
0	1	3.0	3.0
1	1	3.0	3.0
2			

* not including American Indian, Spanish, or Oriental heritage

The burn history of the elderly sample, illustrated in the following table, shows four people (13%) having been burned.

DEMOGRAPHIC CHARACTERISTICS

	N	% Total	% Respondents
Ever Burned:			
Yes	4	12.1	12.5
No	28	84.9	87.5
No Answer	1	3.0	—
Type of Burn			
Scald	1	3.0	25.0*
Contact	2	6.1	50.0
Chemical	1	3.0	25.0
Fire Safety Information			
No Answer	1	3.0	—
No	14	42.4	43.8
Yes	18	54.5	56.2
Fire Department	9	27.3	50.0**
Work	7	21.2	38.9
TV	5	15.2	27.8
Literature	5	15.2	27.8
Teacher	3	9.1	16.7
Movie	1	3.0	5.6
Scouting	1	3.0	5.6
Other	4	12.1	22.2

* % of persons who had been burned (N=4)
** % of persons who had received fire safety information (N=18)

As indicated, just over half (55%) reported receiving fire safety information. The source mentioned most frequently was the fire department (50%), followed by work (39%), television (28%), literature (28%), and teachers (17%). The other sources were mentioned by fewer than 10% each.

Media Habits

There is a great deal of missing data concerning the media habits of the elderly sample. The data which does exist, however, suggests that they watch television every day of the week, mainly in the evening from 8 to 11.

Nature and Extent of Knowledge

Total Scores on the Interview Items

The distribution of scores for the elderly sample is presented on the following page. With a possible score of 90, the scores are very low, ranging from 15 to 50 with a mean of 32.8 and a standard deviation of 7.8. When these low scores are recoded, the sample distributes evenly among the low, high average, and high groups, with very few falling in the low average group.

Recoded Scores

Low (0-28)	Low Average (29-30)	High Average (31-36)	High (37 & over)
33.3%	6.1%	30.3%	30.3%

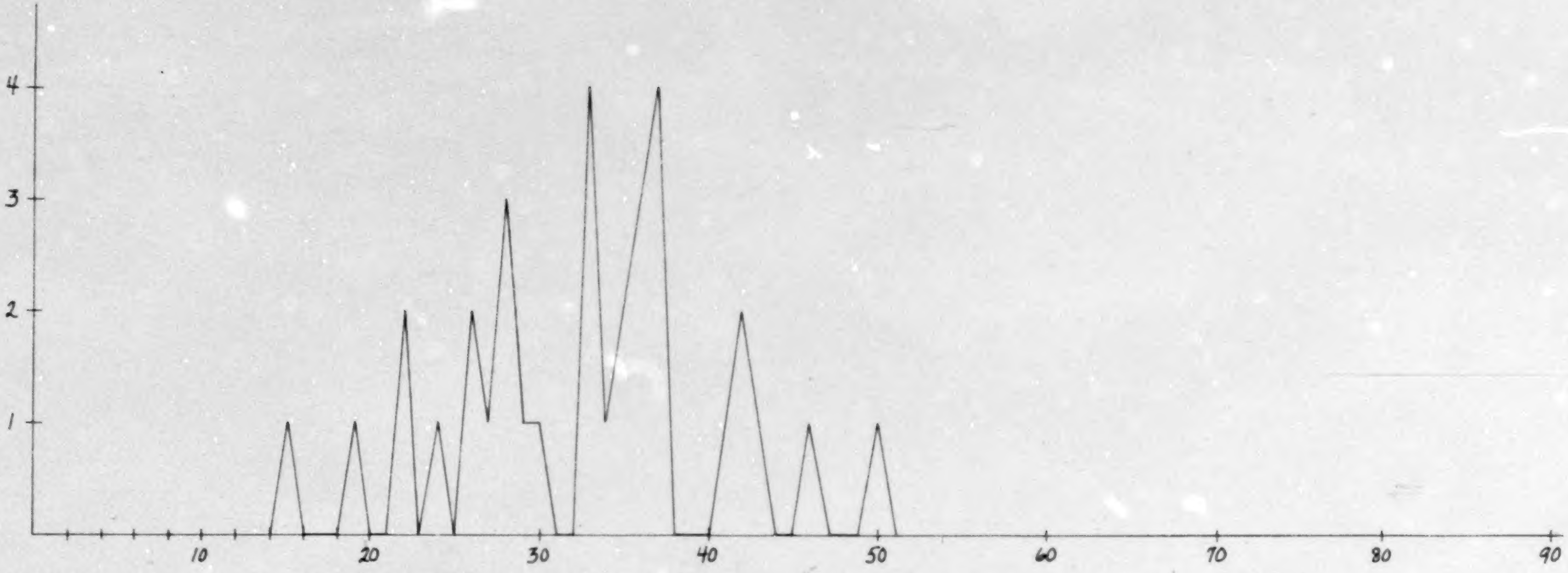
Domains and Related Subscores

The following table presents the average percent correct for each subscore within each domain. The scores ranged from 14% on items related to flammable liquids to 73% for smoke, indicating that some types of information are fairly well known while others are less well understood.

Boston - Elderly - 1976

Total Test Score

N = 33



DOMAINS AND RELATED SUBSCORES

	Total Possible Score	Average % Correct
ALL ITEMS	90	30
Type of Knowledge		
Behaviors to Minimize Harm	5	63
Facts and Concepts	16	37
Preventive Behaviors	24	35
General Awareness	30	22
Type of Burn		
Smoke	1	73
Caustic	2	59
Scald	9	53
Contact	1	46
Flame	48	32
Electrical	11	28
Type of Product		
Flammable Fabrics	20	43
House Fires	6	42
Matches/Smoking Materials	11	42
Ovens/Ranges	5	41
Electrical Sources	11	28
Flammable Liquids	8	14

Within type of knowledge, the elderly did best on items related to behaviors to minimize harm (63%). Knowledge of underlying facts and concepts ranked second (37%), with knowledge of preventive behaviors a close third (35%). Awareness of causes and consequences was lowest (22%).

Within the type of burn domain, the elderly knew most about smoke (73%) and least about electrical burns (28%) and flame (32%). Within type of product, knowledge about four products was about the same: flammable fabrics (43%), house fires (42%), ovens/ranges (41%), matches/smoking materials (42%). The elderly knew far less about electrical sources (28%), and flammable liquids (14%).

Individual Items

As indicated, scores among the elderly were quite low overall. As with the high school sample and other adult populations, the categories used to determine priorities among individual items were: high, over 65% correct; medium, 45 to 65%; low, less than 45% correct. Using these criteria, about the same proportion of items falls into each category.

An examination of items in the low category revealed that several fairly common kitchen fire and burn hazards went unrecognized. The elderly sample did not realize that a pan placed on the stove with the handle over the edge could result in a scald to a person who bumped the handle. Neither did they know that clothing is as likely to be ignited by an electric stove as a gas stove. They did not realize that placing an aerosol can near the stove could cause an explosion, or that storing food over the stove could burn an adult reaching over it or tempt a child to climb on the stove.

The elderly did moderately well at recognizing the following hazards: coffee on a tablecloth in the presence of a toddler; an infant held by a mother drinking hot coffee; an unscreened fireplace; papers placed on a TV. However, they did poorly at explaining why most of these were hazards.

Although the elderly did moderately well in recognizing that the lighter fluid could ignite, few realized that the fumes can ignite, and few knew how to prevent such an accident. They also did not realize that one of the most important things to plan in case of fire is an outside meeting place.

Other items in the medium category pertained to a variety of topics. The elderly people interviewed did moderately well on two items specifically related to their age group: if one has trouble reading container labels, one should enlarge the labels; and if one receives a slight second-degree burn, one should see the doctor. They did moderately well at: recognizing situations that might lead to clothing ignition; knowing what to do if clothing ignites; identifying a safe ashtray; knowing when it is okay to use any size fuse (never); and explaining why it is dangerous to use a towel as a potholder.

Items answered most successfully dealt with why elderly persons are more likely to have accidents with flammable liquids (specifically lighter fluid) and why they die in house fires. Most persons indicated that it is never safe to take a nap while cooking; if one has trouble reading container labels, one should get stronger eyeglasses; and one should only use a potholder or oven mitt to remove pans from the stove or oven. They recognized the danger of running an extension cord under a rug, and knew that it is not safe to store matches over a stove.

General Awareness

The elderly seemed least knowledgeable about burn causes and consequences, with an average percent correct of only 22% for this category. As shown in the following table, most items in the low group related to flame and scald burns.

TYPE OF KNOWLEDGE—GENERAL AWARENESS

Question Number	Objectives	Type of Burn	Type of Product
HIGH			
14b	Recognize particular risks to their age group due to slower reaction time, decreased agility, etc.	Flame	Matches/Smoking Materials
23d	Identify burn risks associated with storage of matches above the stove.	Flame	Matches/Smoking Materials
16	Acquire knowledge of leading fire-related deaths among elderly.	Smoke	House Fire
29	Explain why running an extension cord under a rug is hazardous.	Electrical	Flammable Fabric
MEDIUM			
23a	Explain that using a towel for a potholder may lead to fabric ignition.	Flame	Flammable Fabric
21	Recognize preferred ashtray designs to prevent fire or burns and give reason why.	Flame	Matches/Smoking Materials
29	Identify fabric ignition as a risk of using an unscreened fireplace.	Flame	Flammable Fabric
15	Recognize proper precautions to prevent themselves from fire or burn harm (place decal on window; inform fire dept. where they sleep).	Flame	House Fire
14a	Given a situation, analyze common causes of fabric ignition in conjunction with vapors of flammable liquid (lighter fluid).	Flame	Matches/Smoking Materials
23b	Given a kitchen scene, identify common situations which may cause a scald and explain why.	Scald	
LOW			
23c	Explain burn risks associated with storing goodies above the stove.	Flame	
18	Acquire knowledge that one is at equal risk of clothing ignition from gas and electrical stoves.	Flame	Flammable Fabric
24a	Recognize correct placement of cooking pots on a burner to prevent scalds.	Scald	Ovens/Ranges

When presented with a kitchen scene full of several burn hazards and asked how to make the room safer from burn injuries, few (3%) indicated that cookies should not be stored over the stove. Very few people identified the following potential dangers: direct contact with a hot object or flame (33%); electrical burns/shocks (3%); steam burns (0%); or burns from flammable liquids near a source of ignition

(0%). In a related question, only 15% correctly checked that the danger of clothing ignition while using an electric stove is about the same as when using a gas stove; 73% felt that an electric stove was slightly less dangerous. Only 30% selected as "safest" the picture showing all cooking pots placed on burners of the correct size with handles turned inward. One-third selected a picture showing a pot with its handle sticking over the edge of the stove, and 20% chose a small pot cooking on a large burner.

The elderly did moderately well on several items related to flame burns. They were presented with the following situation:

> Seventy-year-old Mrs. Smith spilled some lighter fluid on her dress while filling her cigarette lighter. When she lit her cigarette, her clothing burst into flames.

About two-thirds (63%) explained correctly that the cause of fire was either lighter fluid in the clothing which ignited (48%) or fumes which ignited (15%). However, about 15% thought the clothing was flammable, and 6% mentioned the fumes only.

In the kitchen scene, over half explained that certain common situations may cause scalds. Specifically: drinking a hot beverage with an infant in the lap and sitting at a table covered with a cloth; handling hot liquid in a pan. The elderly also did moderately well in explaining the risks of fabric ignition when using an unscreened fireplace and on selecting the picture of the safest ashtray design and explaining why it is safe (each item answered correctly by about one-half of them).

Another item answered moderately well related to facilitating the work of the fire department. When asked, "How can the fire department better help disabled and partially-disabled people in the case of a fire?" slightly under half of the sample correctly checked "If they are informed where a disabled person lives" or "If a decal is placed on the window where the disabled person sleeps." However, about one-third incorrectly checked "If the disabled person is trained to escape from a window."

The elderly sample scored highest on items involving certain risks to their age group. For example, about 75% knew that the leading cause of death among elderly persons involved in fires is smoke inhalation. They also knew that slower reaction time or physical disability because of age, weakness, etc., put the elderly at risk in certain situations (such as spilling lighter fluid or dropping a cigarette). Most knew that running an extension cord under a rug is a potential fire hazard and almost all (97%) realized that matches stored in the cupboard above a stove could be ignited.

Preventive Behaviors

Knowledge of preventive behaviors ranked third highest overall, with only 35% as the average percent correct. As the following table indicates, the preventive measures of not storing goodies above the stove and keeping flammable liquids away from the stove were least well known. When told about a woman who spilled lighter fluid on her clothes, then lit a cigarette, and then had her clothing ignite, and asked how she could have prevented injury, only 20% provided appropriate answers: change the dress before smoking (12%); do not fill lighter over yourself (6%). Over a third could not give an answer; 12% said not to use the cigarette lighter; and 3% each said roll on the floor or wait until excess fluid evaporated. Nobody mentioned asking someone else to fill the lighter.

People scored moderately well on the following items: using a potholder instead of a towel when working at the stove (15%); if an elderly person has difficulty reading labels, put larger labels on the containers (49%) in order to prevent caustic burns from swallowing or smelling products to identify them. About half (51%) correctly identified the safest container for storing gasoline (metal with pressure release valve); almost 30% chose a plain metal-capped can and 15% chose a metal can with a spout.

The items answered correctly by over 65% of the sample related primarily to certain stove precautions and house fires. About 70% checked that it is unacceptable to take a nap while food is cooking, even if: the timer is left on the oven for less than an hour (6%); the stove is left on low (12%); the pot in which the food is contained is sturdy (0%). Seventy percent recommended stronger eyeglasses for people who had trouble reading labels. They selected the correct items for taking a hot pot off the stove: potholder (73%) and oven mitts (79%). However, when multiple-choice responses were not available, they did only moderately well in picking out the correct items from a kitchen scene.

When asked to complete the sentence, "As part of a home fire exit drill the most important thing to plan would probably be...," most checked escape routes (76%); but very few checked another critical element of the plan--an outside meeting place (3%).

TYPE OF KNOWLEDGE—PREVENTIVE BEHAVIORS

Question Number	Objectives	Type of Burn	Type of Product
HIGH	Recognize that to prevent burns one should:		
22	Use only potholders or oven mitts, never a towel, to remove pots from the stove.	Flame	Flammable Fabric
17	Never leave pans cooking on the stove unattended.	Flame	Ovens/Ranges
20(50)	Have strong enough eyeglasses to read labels on caustic substances.	Caustic	
25(c)	Plan an outside meeting place as a part of a fire exit drill.	Flame	House Fire
MEDIUM	Recognize that to prevent burns one should:		
23a	Use a potholder, not a towel, to remove items from the stove.	Flame	Flammable Fabric
26	Store gasoline in a tightly capped metal container with a pressure release valve.	Flame	Flammable Liquid
20(51)	Put large labels on caustic substances.	Caustic	
LOW	Recognize that to prevent burns on should:		
23c	Not store goodies above the stove or flammable liquids near the stove.	Flame	Flammable Liquid
14c	Not fill a cigarette lighter over your clothing.	Flame	Matches/Smoking Materials
24	Position pots on correct-size burners with handles turned inward.	Scald	Ovens/Ranges

Facts and Concepts

Knowledge of facts and concepts ranked second highest (37% correct) within the type of knowledge domain. No items fell into the high category.

When asked to rank cotton, nylon, wool, and fiberglass according to burning speed, only 24% correctly identified cotton as the fastest burning fabric. Almost half (49%) said that nylon presents the greatest risk.

People also scored poorly when asked why there is a risk of an electrical shock or burn in the following situation:

> Mrs. Smith was hurrying to make a pot of morning coffee. She plugged one end of the electrical cord into the wall receptacle, filled the pot with water and went to plug the female end of the appliance into the pot.

Very few of the elderly sample said, "The female end of the cord carries live electricity" (15%); or, "The electricity could easily ground itself through her body" (6%). However, the majority (55%) did know that wet hands would risk a shock or burn.

Answered moderately well was another item related to electrical burns. When asked to complete the sentence, "It is okay to use any size fuse if...," over half (55%) correctly answered "never"; others either did not answer the question or said that it is okay if "some of the electrical appliances are disconnected" (3%), or "it fits" (3%).

TYPE OF KNOWLEDGE—FACTS AND CONCEPTS

Question Number	Objectives	Type of Burn	Type of Product
HIGH			
—	—	—	—
MEDIUM			
27	Recognize causes of possible electrical shock or burns from electric appliance cords (water conducts electricity).	Electrical	Electrical Sources/ Appliance Cords
25e	Identify correct amperage of most common household fuses.	Electrical	Electrical Sources
LOW			
28	Identify relative burning speeds of common fabrics.	Flame	Flammable Fabric
27	Recognize causes of possible electrical shock or burns from electric appliance cords (grounding, live electricity).	Electrical	Electrical Sources/ Appliance Cord

Behaviors to Minimize Harm

The elderly seemed to do best overall on behaviors to minimize harm (63%) correct), with no individual items falling in the low category. Items relating to flame and contact burns were answered moderately well. When asked, "If your clothing catches on fire the first thing you should generally do is...," the majority (61%) correctly said "drop and roll." Incorrect responses, however, included tearing off your clothes quickly (15%), smothering the fire by wrapping oneself in a blanket (12%), and beating out the flames with your hands (9%).

The following situation was presented:

> Mr. Jones, an elderly gentleman, got a slight

> second-degree burn to his hand while cooking dinner. While painful, it did not seem serious to him. He should:

Slightly less than half (46%) correctly checked that an elderly person should seek medical help. Thirty percent answered that butter should be put immediately on the burn.

The sample scored best on behaviors to minimize harm associated with the following problem: "If you spilled a cup of coffee on your pants, the first thing you should do is...." About 70% correctly said wet clothes should be removed and/or pulled away from the skin. Almost 20% said the scalded person should first apply cold water to the burn. Three percent said lotion or butter should be applied.

TYPE OF KNOWLEDGE—BEHAVIORS TO MINIMIZE HARM

Question Number	Objectives	Type of Burn	Type of Product
HIGH	Recognize that to minimize harm once a burn is in progress one should:		
25(a)	First remove clothes if scalded through them.	Scald	
MEDIUM	Recognize that to minimize harm once a burn or fire is in progress one should:		
25(d)	Drop and roll to extinguish flames.	Flame	Flammable Fabric
19	Seek medical help if elderly (due to conditions of age).	Contact	
LOW			
—	—	—	—

Behaviors and Practices of the Elderly

The elderly sample's reports on their own behaviors and practices were related to flammable liquids, fireplaces, power equipment, gasoline storage, space heaters, smoke detectors, escape plans, ovens/ranges, flammable fabrics, and fire department inspections.

The majority said they do not store flammable liquids, have fireplaces, operate gas-powered equipment, or use space heaters. Of those who do, most follow generally safe practices. Some exceptions were using the fireplace to incinerate trash, and going to bed while a fire is still burning or smoldering. (In housing for elderly, it is possible that someone else is responsible for checking fires.)

It is interesting that the elderly scored higher on items relating to smoke, burns, and house fires. Half of them had smoke detectors in their homes (again, these may be required in housing for the elderly), and 61% had an escape plan in case of a house fire. Unfortunately, only half of those who had plans had ever practiced them.

Most of the sample (61%) reported that they did not store flammable liquids such as paint thinner, turpentine, or alcohol in or near their homes. Those who did used metal containers with tight-fitting caps and tended to store such items in the basement of the house or in a garage attached to the house.

Most homes in which the elderly live do not have fireplaces (88%). The few persons who did have fireplaces reported that they are not cleaned and inspected regularly. However, they also said they did not use gasoline or other flammable liquids to ignite or increase the fire (75%), and never used the fireplace for cooking (100%). Everyone kept a screen in front of the fireplace when using it (100%). Surprisingly, 75% mentioned incinerating trash in the fireplace; only about half kept the area free of flammable items. About half of the sample said they would go to bed while a fire was still burning or smoldering in the fireplace.

Only three people (9%) ever operated gas-powered equipment, usually a lawn mower or chain saw. All three kept gasoline on hand, usually in a garage attached to the house, and one person emptied the gas tank before putting the equipment away.

Only one person (3%) had used a space heater in the home. That person generally followed all safety precautions regarding its use, except for placing the electric space heater in the bathroom on occasion.

Half of the sample (51%) had smoke detectors in their homes. Of those who did not, about 9% had considered installing them.

Ninety percent said they had two escape routes for every room in the house. The majority also had escape plans in case of a fire (61%); however, only half had actually practiced their plans.

With regard to ovens and ranges, most had knobs which turn through a progression of temperature settings before coming to full heat (79%) and are located so the person does not have to reach across the burners to turn them on and off (82%). Most of the sample had electric stoves (80%) with signal lamps (93%) that light up when a burner or oven is on and working properly (89%). Most people said they did *not* wear loose-fitting clothing or large sleeves when cooking at the stove (86%). They said they did not leave matches on tables or counters (70%), and that they closed the cover of a matchbook before striking a match (82%).

When buying clothing, the majority (67%) said they did not check tags to see if the clothing was flame-resistant material. Most (about 90%) were unsure whether they owned flame-resistant clothing.

The majority (75%) had never requested their local fire department to inspect their homes. Only 3% agreed to let the project interviewer arrange for a fire inspection of their home. However, it should be noted that most of these people lived in housing projects for the elderly, where decisions about safety inspections are made by the management rather than by residents.

Is knowledge related to selected sample characteristics?

Burn prevention knowledge among elderly citizens was examined in terms of sex, socioeconomic status, income, and previous burn/fire safety information. This last characteristic was the only one significantly related to knowledge: elderly persons who had received fire safety information did significantly better overall than persons who had not received such information.

Knowledge by Sex

As shown in the two tables below, there was no significant difference between the sexes on overall scores or recoded scores.

Sex	N	Mean*	Standard Deviation
Male	16	31.6	7.2
Female	16	34.3	8.4

*A t test on raw scores resulted in failure to reject the H^0 at level $\alpha = .05$.

Recoded Scores*

Sex	N	Low (0-28)	Low Average (29-32)	High Average (33-36)	High (37 & over)
Male	16	43.8	6.3	18.8	31.3
Female	16	18.8	6.3	43.9	31.3

*A chi-square test on raw scores resulted in failure to reject the H^0 at level $\alpha = .05$.

As the following table shows, significant differences exist between men and women in only two domains. Women did significantly better than men on scalds within the type of burn domain and on ovens/ranges within the type of product category.

KNOWLEDGE BY SEX
(expressed in average percent correct)

	Male	Female
ALL ITEMS	35	38
Type of Knowledge		
Facts and Concepts	36	37
General Awareness	20	24
Preventive Behaviors	34	37
Behaviors to Minimize Harm	61	69
Type of Burn		
Flame	32	32
Contact	38	56
Caustic	69	50
Smoke	75	75
Scald*	38	69
Electrical	30	25
Type of Product		
Flammable Liquids	14	13
Ovens/Ranges*	28	55
Flammable Fabrics	43	45
Matches/Smoking Materials	40	43
Electrical Sources	30	25
House Fires	45	40

*A t test on raw scores resulted in rejection of the H^0 at level $\alpha = .05$.

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Knowledge by Socioeconomic Status

As illustrated in the following table, there were not significant differences across socioeconomic groups for overall scores. Because of the small sample sizes, caution must be used in interpreting the data.

SES	N	Mean*	Standard Deviation
2	6	36.3	5.0
3 (middle)	9	35.3	9.6
4	11	30.5	6.4
5 (low)	3	33.7	4.9

*An ANOVA test on raw scores resulted in failure to reject the H^o at level α = .05.

Knowledge by Income

Similarly, differences across income groups were not significant.

Income	N	Mean*	Standard Deviation
$5,000	12	32.8	10.1
$5,000-10,000	10	33.2	5.1
$10,000-15,000	4	33.2	5.0
$20,000-25,000	1	42.0	0.0
$25,000	2	34.5	9.2

*An ANOVA test on raw scores resulted in failure to reject the H^o at level α = .05.

Knowledge by Fire Safety Information

Elderly persons who had received fire safety information did significantly better overall than persons who had not.

Received Fire Safety Information	N	Mean*	Standard Deviation
Yes	18	36.2	6.6
No	14	28.3	7.5

*A t test on raw scores resulted in rejection of the H^o at level α = .05.